Comprehensive Family Immunization Project / FCH

Measles, Rubella and CRS

Rubella Watch

Compendium of Measles Articles

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Compendium of articles originally published in the EPI Newsletter / Immunization Newsletter

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Preface

In 1994, the Member States of the Pan American Health Organization/World Health Organization (PAHO/WHO) adopted the initiative to eliminate measles from the Americas. In 2003, they adopted the initiative to eliminate rubella and congenital rubella syndrome (CRS) from the Region. In order to implement both initiatives, vaccination and surveillance strategies were executed with the objective of rapidly reducing the number of new cases and interrupting endemic transmission of both diseases.

It is my privilege to present this compendium designed to tell the story of measles, rubella, and CRS elimination and compiling all the articles published on these diseases in the PAHO/WHO *Expanded Program on Immunization (EPI) Newsletter,* now the *Immunization Newsletter.* The objective of the present publication is to document the regional experience. In particular, it aims to convey to countries and other regions of the world the lessons learned, along with experiences gained from other vaccine-preventable disease elimination initiatives and best practices developed. A growing body of knowledge on how to implement these initiatives and achieve the elimination goal has been accumulated over the 15 years of this process.

The compendium also attempts to pay a graphic and written tribute to the legion of men and women—health workers and volunteers—who have contributed to measles and rubella elimination through their work in and with communities, even under unfavorable circumstances. Without their persistence, dedication, and unwavering determination, the initiative could not have moved forward.

The Americas have laid the foundation for the elimination of vaccine-preventable diseases. The experience of the Region in measles and rubella elimination has demonstrated that we can conquer a disease if we work in unison, recognizing the strength of team work and embracing the richness of diversity among people and communities. The pages of this book highlight Pan-Americanism in action, which has promoted continuous exchange and learning between peoples of the Americas.

Finally, this publication contributes to the strengthening of one of PAHO's institutional principles by which shared information and knowledge is a source of power and serves to improve the condition of all people—*pro salute Novi Mundi.*

Mirta Roses Periago
Director

Foreword

The partnership between countries and the international community has played a decisive role in the achievement of immunization goals in the Western Hemisphere. The focus of this partnership has been to support country efforts to build robust and equitable national immunization programs that can effectively control vaccine-preventable infectious diseases and respond to emergency epidemics as these arise. The legacy of this joint collaboration is a Region with the world's lowest morbidity and mortality rates from vaccine-preventable diseases and one of the largest and most sophisticated network embracing countries, civil society, non-governmental organizations, bilateral and multilateral organizations, the scientific community, and the private sector.

The proven impact of national immunization programs in the Americas in reducing poor health due to vaccine-preventable diseases has placed immunization goals prominently on the global agenda for sustainable development and poverty reduction. The Region remains a pioneer in generating valuable knowledge and experience in the use of strategies and tactics which continue to benefit immunization programs worldwide. Breakthroughs include critical knowledge in improving managerial capabilities and accountability of public health staff responsible for immunization programs at the national and sub-national levels, even in countries undergoing political and economic hardship.

The *EPI Newsletter,* established in 1979, has chronicled the history of the successful partnership between the Pan American Health Organization (PAHO), national immunizations programs, and the international community, beginning at a time when vaccination coverage for children under the age of 1 year old barely reached 25%–30% for diphtheria, tetanus, pertussis, polio, measles, and tuberculosis, to today's coverage of over 90%. The *EPI Newsletter* has documented PAHO's critical work with countries in establishing an adequate surveillance, services delivery, and diagnostic infrastructure, and in ensuring the utilization of quality vaccines and the presence of regional production capacity for vaccines of public health importance. The *EPI Newsletter* has underscored the contribution of the Revolving Fund for Vaccine Procurement, created as part of the Expanded Program on Immunization (EPI) 32 years ago. The Revolving Fund is a public good that has facilitated the availability of high-quality vaccines supplied in adequate quantities, in a timely fashion, and at the lowest prices. Likewise, it has highlighted PAHO's work with its Members States in the achievement of broad-based community and public-private partnerships that continue to bring us closer to realizing the goal of equitable vaccination.

Immunization programs in the Region are now responding to the rapid technological changes in the field of vaccination brought about by the development of new generations of vaccines of public health importance. These vaccines have the potential to simplify immunization delivery, improve the performance of existing vaccines, and protect against other vaccine-preventable diseases. However, this new breed of vaccines is considerably more costly calling for heightened cooperation among public and private partners alike.

I congratulate the *EPI Newsletter,* as it celebrates its 30 years, for its efforts to keep us abreast of important milestones achieved by the countries of this Region in partnership with the international community and urge it to continue its strategic role of sharing critical information and knowledge that will enable immunization programs throughout the world to face the challenges that lie ahead.

Socorro Gross-Galiano
Assistant Director

Contributing to the Sharing of Experiences and Continuous Learning in the Americas

Gina Tambini, MD, MPH
Area Manager for Family and Community Health
Pan American Health Organization

Effective knowledge management is essential for improving the efficacy of interventions aimed at increasing gains in health and improving the quality of life of the people of the Americas. The documentation of experiences, lessons learned, and/or good practices in a specific area is a classical example of a public good that has become critically important in a world where booming communication technologies play a dominant role.

This publication is a compendium of all the measles articles published in the *Immunization Newsletter,* taking on the challenge of systematizing the cumulative experience of the Americas in eliminating rubella and CRS. On reviewing the content of this publication, the reader will discover that the vast national and local experiences presented reflects both the diversity of our Region as well as common epidemiological trends, achievements, and challenges of the elimination initiative.

For almost 30 years, timely dissemination of these experiences through the pages of the *Immunization Newsletter* has enabled health professionals in the countries to develop and strengthen a wide range of capacities. Many of the articles required the collaboration of these professionals, thus helping to improve their skills in analysis, synthesis, and praxis, demonstrating that knowledge derived from the measles elimination initiative could be applied in daily practice. Scientific writing skills are another competency that was developed, leading to quality improvements in scientific knowledge production in the Region.

Perseverance in the publication of measles articles has contributed to the dissemination of knowledge on the elimination of vaccine-preventable diseases to the Member States of the Pan American Health Organization and to strategic partners. The Region of the Americas is facing a changing landscape, and with it, new challenges to the continued promotion of health and equity. It is therefore essential that inspiring instruments, such as this publication, are available to facilitate the implementation of successful health initiatives and to improve the quality of life in the countries of the Americas. I am certain that this publication will provide a public health legacy for present and future generations.

Promoting Equitable Access to Information and Knowledge

Cuauhtémoc Ruiz Matus, MD, MPH
Senior Immunization Advisor
Pan American Health Organization

For 30 years, the *Immunization Newsletter* has been the mechanism for disseminating information on best practices and lessons learned from the Expanded Program on Immunization (EPI) in the Region of the Americas. Each of its articles has been testimony to the resolve, dreams, hopes, and achievements of intrepid health workers and communities in their efforts to control vaccine-preventable diseases. Examples of these triumphs are the epidemiological control of measles and rubella, which, through the firm tenacity of the countries of the Americas and the Pan American Health Organization/World Health Organization (PAHO/WHO), the lofty dream of a Hemisphere free of measles, rubella, and congenital rubella syndrome (CRS) is becoming a reality.

This compendium of measles and rubella articles presents historical proof of the joint efforts to eliminate the two diseases, thus revealing the commitment, effort, humanity, and extraordinary technical capacity provided at local and national levels to make elimination possible. It also reflects the Pan American spirit and ideal; through united efforts we have made these achievements possible. We cannot forget that this success is a victory of partnerships.

Today, when the world is discussing the possibility of eradicating measles, documentation of the experience of the PAHO/WHO Member States in measles and rubella elimination represents a wealth of knowledge for the annals of public health, promoting equitable access to knowledge and information to foster evidence based decision-making and best practices. The ability to disseminate and share knowledge has been key to the success of the measles and rubella elimination initiatives in our Region: through communication we have been able to inform, encourage, recognize, and motivate the people of the Americas to remain faithful to their intense commitment to equity and to reach the highest attainable level of health for all by all.

May this compendium serve as homage to all those, who from diverse locations, positions, and responsibilities have managed to make the Americas a measles- and rubella-free hemisphere. This publication will surely foster a heightened awareness of history and a better understanding of the present. Above all, it will better prepare us for a bright future in public health, especially in the control of vaccine-preventable diseases.

Ciro A. de Quadros, MD, MPH
President of the Technical Advisory Group
on Vaccine-preventable Diseases
Executive Vice Presidente
Albert B. Sabin Vaccine Institute

Testimony of the First Editor

The Pan American Health Organization (PAHO) Expanded Program on Immunization (EPI) was established by Resolution XXVII of the XXV Meeting of the Organization's Directing Council, in September, 1977. In May, 1979, the Program published the first issue of what was then called the *EPI Newsletter.*

Introducing this PAHO periodical publication, the then Chief of the PAHO's Division of Disease Control, Dr. Luis Carlos Ochoa, stated that the newsletter was "created in response to the suggestions and recommendations of more then 130 nationals from all the Latin American countries that participated in the four regional EPI courses held from May 1978 to January 1979." He also stated that the purpose of the periodical publication was "to continue the process begun at these courses, of exchanging skills, knowledge and information relevant to the Expanded Program on Immunization in the Region of the Americas."

The publication, he stated "was intended to create a flow of information in the Region about all aspects of program implementation, from scientific articles on the target diseases and vaccination to practical matters of the day-to-day running of an immunization program."

And indeed, over the last 30 years this publication, now called *Immunization Newsletter* has maintained a high standard of scientific quality in all these aspects serving as one of the main vehicles of information to program managers and policy makers.

Most importantly, the newsletter has stimulated program officers, both at the country level as well as members of the EPI staff at PAHO, to strive to collect and analyze information relevant to program implementation and contribute with articles and news that most certainly have helped set and/or modify strategies relevant to the control and eradication of vaccine-preventable diseases in the Region of the Americas. It has also served as a forum for the discussion of issues and ideas that helped improve the quality of national programs, as well as created an *esprit de corps* or group morale, among those involved with the program.

I want to take this opportunity to congratulate the entire staff of immunization programs throughout the Region and those at PAHO for the outstanding work that has been developed over these last 30 years, and that have been reflected in the quality of the publication.

Finally, I pay tribute to the Editors and Co-Editors that have followed after my tenure, as well as all the contributors to the various issues of the newsletter, for maintaining the same spirit that guided the launching of this important periodical publication.

Jon Kim Andrus, MD
Immunization Advisor
Pan American Health Organization

Through Information Exchange, Cultivating a Culture of Prevention

In the 32 years since the Expanded Program on Immunization was launched in the Americas, polio has been eradicated and measles has been eliminated. Perhaps more importantly, thousands of health workers working at the point of service have been trained in the principles of good public health practice and prevention. These same health workers have consistently executed the necessary strategies to reduce morbidity and mortality of vaccine-preventable diseases. Improving management of immunization services at district-level is the cornerstone of their work. It is upon this foundation of good public health practice that the vision for future public health improvements rests.

Critical for the progress achieved and this vision of the future has been the sharing of information and experiences between countries. To that end, we believe the *EPI Newsletter,* subsequently renamed the *Immunization Newsletter,* has played a vital role in the documentation of strategies and tactics that are successful in reducing the disease burden of vaccine-preventable diseases. Continuously improving the way we manage information should also lead to increased knowledge and improved behavioral practices.

While protecting and sustaining the achievements in polio and measles initiatives, the program is posed to complete and sustain the elimination of rubella and congenital rubella syndrome (CRS). Like polio, CRS causes life-long suffering for children and their families. Efforts to reach and vaccinate adults should impact women's health given that rubella elimination has reached those who are marginalized and otherwise do not benefit from preventive services.

Ultimately, the future of immunization will hinge upon how well we leverage inter-disciplinary partnerships, and how well we share our experiences in reducing existing health disparities. New, life-saving vaccines must be made available to those who need them most. Within the next 10 years as many as 10 new vaccines may become available. We now have vaccines for prevention of human papillomavirus infection and cervical cancer, but they are not accessible to our communities in need at their current prices. As these vaccines are introduced, PAHO's role will be to ensure that they are made available in a sustainable fashion to those who need them most, in particular the poor, the underserved, and the marginalized populations of our hemisphere. To that end, the *Immunization Newsletter* will continue to be ready and willing to support health program services in all Member States of the Pan American Health Organization.

1979

May 1979
Volume I, Number 1

Research: Measles Vaccination

Vaccinating a child is a time-consuming and costly process. With so much effort and cost going into each vaccination, it is most important that the vaccinations given be as effective as possible in terms of greatest protection for the child. Scientific discussion has arisen as to the best time to give measles vaccine, presently the most expensive of the EPI vaccines, to protect the child at the earliest possible age, yet after the protection and interference of maternal antibodies has ended.

Maternal antibodies against measles are transmitted through the placenta. These antibodies provide infants with some protection against measles in the first several months of life and also interfere with production of measles antibody following vaccination in very young infants.

Several recent studies in the United States have revealed that these maternal antibodies may persist in infants and interfere with the infant's response to measles vaccine even beyond the 12th month of extrauterine life. Up to 22% of infants in these studies failed to develop antibodies to measles when vaccinated at 12 months of age. Children vaccinated at or after 14 months of life had seropositivity rates or seroconversion rates of at least 93%. Since measles infection is unusual in the first year of life in U.S. children, the recommended age for routine administration of measles vaccine has recently been changed to 15 months.

However, in many other countries, 30% or more of the children will have already developed measles by 12 months of age. 'The highest incidence of death due to measles occurs in the first two years of life, and measles case fatality rates in excess of 10% have been noted in children under 12 months of age, especially in areas with a high prevalence of malnutrition. Therefore, delay of measles vaccination until after 12 months of age would allow a significant percentage of the morbidity and mortality due to measles to continue in these countries. A recent study in Kenya revealed that 92% of infants beyond 7 1/2 months of age did not have detectable hemagglutination-inhibition (HI) antibodies to measles, and over 90% seroconverted after administration of measles vaccine. In separate studies in Rhodesia and South Africa, 97% of children seroconverted to measles vaccine at 9 months of age. The age incidence of clinical measles in Latin America is reported to be similar to that found in African countries.

The vaccines used in the U.S.A. and African countries were all further attenuated measles vaccines. Why children from African and Latin American countries become susceptible to measles and respond to measles vaccination at younger ages than do children from the United States is not known. The level of maternal antibody has been shown to correlate with the level of measles antibody in cord blood, and infants whose mothers had lower levels of measles antibody seroconverted to measles vaccine at younger ages. Infants born prematurely have been shown to seroconvert to measles vaccine at younger ages than term infants, presumably because they receive less maternal antibody before birth. Other as yet undetermined factors probably influence the rate at which children lose maternal antibody and become susceptible to measles or responsive to measles vaccine. Race, anemia, and underlying nutritional status may be some of these factors, but have not yet been evaluated in this regard. It is important to identify the factors influencing the persistence of maternal antibody so that every country does not have to carry out an independent study to determine the earliest age at which measles vaccine can be effectively administered.

Measles vaccine is expensive. In order to gain the maximum benefit from this investment, children should be vaccinated as soon as possible after maternal antibody will no longer interfere with the antibody response following vaccination, but before the children have had an opportunity to develop measles. Therefore, the final decision as to the optimal age of vaccination is also dependent on the morbidity and mortality caused by measles in the first year of life in a particular geographic area.

With the primary objective of determining the immunological effectiveness of administering measles vaccine to children between 6 and 12 months of age in Latin America, investigators in four countries—Brazil, Chile, Costa Rica and Ecuador—are conducting an inter-american study with the cooperation of PAHO/WHO. Results of this study are expected by the end of 1979. The information obtained, together with data from epidemiological surveillance of measles, will permit determination of the optimum age for measles vaccination in the Region of the Americas.

September 1979
Volume I, Number 3

Measles: An Outbreak in Panama City, 1978

Between August and October 1978, the Office of Epidemiology received reports of 174 cases of measles in the metropolitan area of Panama City.

Active case-finding in the records of the Children's Hospital by the Central Nursing Bureau of the metropolitan area turned up information on 435 cases of measles treated in the emergency ward, most of which had not been previously seen in health centers.

This showed that the magnitude of the problem was greater than that conveyed by the records of the metropolitan area.

This outbreak occurred barely a year and a half after the end of the previous measles epidemic in this region (Figure 1). In the intervening period (April 1977 to August 1978) there was an average of 15 cases a month. The 32 cases of September are regarded as the onset of the epidemic.

Two deaths were identified during this epidemic, both in the San Miguelito district—a poor quarter of the city. The age distribution of the cases reported in the metropolitan area between August and October was as follows (Table 1):

TABLE 1.

Age group	No. of cases	%	Rate per 100,000 inhabitants
Under 1 year	49	28.2	269.3
1-4 years	80	46.0	112.9
5-9 years	26	14.9	32.0
10-14 years	10	5.7	14.1
Not specified	8	4.6	...
15 years and older	1	0.6	...
TOTAL	174	100	27.5

The sex distribution was even. In regard to age, the highest incidence was among children under one year of age. Forty-eight of the 49 cases in this age group were between 6 and 11 months old.

According to the monthly reports turned in by the health centers, the measles vaccination coverage in the metropolitan area was as follows (Table 2):

TABLE 2.

Age group	1976	1977	1978 (First semester)
Under 1 year	33.4%	26.7%	34.4%
1-4 years	38.1%	59.0%	...

The following vaccination histories were obtained on 105 of the 174 cases reported (Table 3):

TABLE 3.

Vaccine	Vaccinated	Not vaccinated	Unknown	% vaccinated
Measles	11	56	38	10.5
DPT	28	44(*)	33	26.7
Polio	27	45(**)	33	25.7

(*) Includes 17 who did not receive the full course of inoculations.
(**) Includes 32 who did not receive the full course of inoculations.

These figures show that, for every four of these children, only one had been vaccinated for DPT and polio. This means that, just as these children contracted measles, they are in equal danger of contracting any of the other diseases. The aforementioned survey showed that 72.2% of the affected children had always lived in the same house. Thus, population movements were not a decisive factor in the low vaccination coverage.
Some of the reasons for these children not having been vaccinated are, according to the survey, the following:

a. Failure to show up for appointments even in the wake of household visits.
b. Unverifiable reports by mothers that their children had already had measles.
c. Refusal by the mother to allow her child to be vaccinated.
d. Illness on the day of the appointment.
e. Control in a private clinic.
f. Control in the Social Security service.
g. Lack of vaccine in the health center on the day of the appointment (2 cases).

Following are the salient conclusions and recommendations of the Office of Epidemiology, which are now being implemented:

1. The need to plan for a permanent vaccination service at each health center as of 1979.
2. A public information and community motivation campaign to demonstrate the importance of vaccinating all susceptible children and to emphasize the parents' responsibility for ensuring that this is done.
3. The establishment of contacts with authorities, national leaders, government organizations, occupational associations and individuals to enlist their influence on segments of the population so as to improve communication between the community and the health institutions.

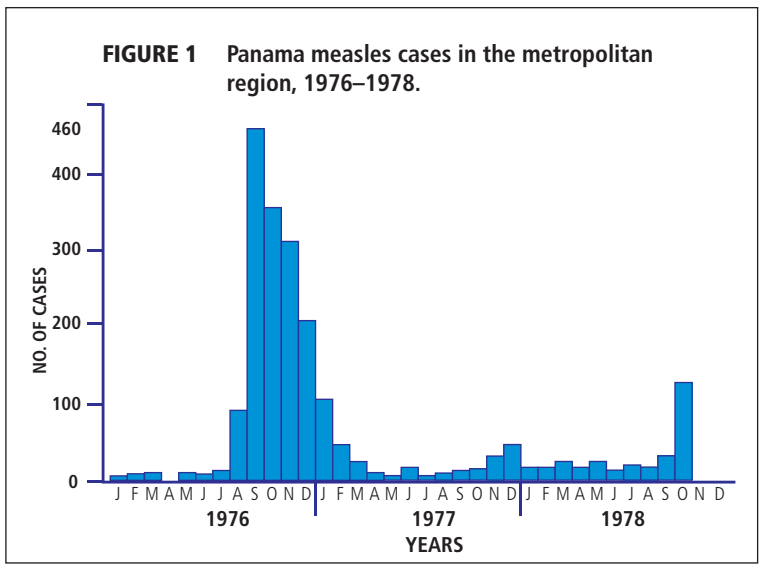


FIGURE 1 Panama measles cases in the metropolitan region, 1976–1978.

Source: Bol. Epid. Panamá, Vol. III, No. 11, Nov. 1978.

September 1979
Volume I, Number 3

Measles in the Region of the Americas, 1971-1978

In the period 1971-1977, 28 countries in the Region reported to PAHO an annual average of 258,634 cases of measles (see *EPI Newsletter* No.1). In 1978 29 countries reported 233,408 cases of this disease. These 29 countries have been divided into three groups according to their location.

Figure 1 shows the cases reported between 1971 and 1978 by the countries in group 1: the United States and Canada (North America).

Figure 2 shows the cases reported by group 2 countries: Mexico, Guatemala, Honduras, Panama, Nicaragua, E1 Salvador, Costa Rica, Jamaica, the Bahamas, Barbados, Cuba, Dominica, the Dominican Republic, Grenada, Haiti and Trinidad and Tobago (Central America and the Caribbean.

Figure 3 shows the cases reported by group 3 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Uruguay, and Venezuela (South America).

The decrease in the number of cases reported in 1974 and 1975 followed the large scale introduction of measles vaccine in most of the countries in the Region.

The subsequent rise in the number of measles cases reported in 1976-1977 may have been mostly due to the lack of routine immunization programs integrated within the health delivery systems of many nations.

Figures for 1979, compared with those for the same periods in 1978, show that the number

FIGURE 1 Reported cases of measles in the United States and Canada, 1971–1978.

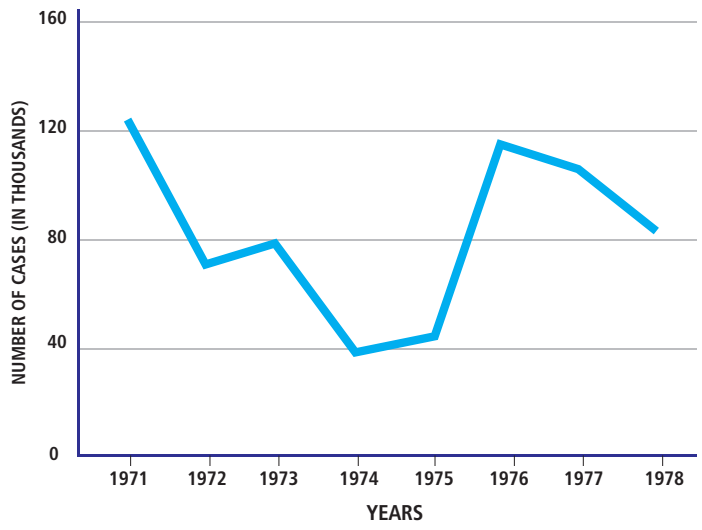


FIGURE 2 Reported cases of measles in Central America and the Caribbean, 1971–1978.

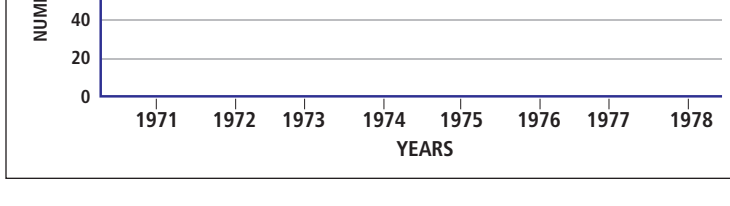


FIGURE 3 Reported cases of measles in South America, 1971–1978.

of cases reported in group 1 countries has increased by 21.2%. (The United States, however, showed a decrease of 47.7%.)

Countries of groups 2 and 3 also showed increases, of 167% and 80%, respectively, for comparable periods of time in 1978 and 1979.

December 1979
Volume I, Number 4

Improved Stability of Freeze-dried Measles Vaccine

Tests have recently been completed at a WHO Reference Laboratory comparing the heat stability of measles vaccine produced by several manufacturers. Vaccines stored for varying intervals at 37°C and 45°C were assayed using the microfocus method, with the results being expressed as plaque-forming units (PFU) per single human dose. Two indices of stability were then calculated:

1. the half-life in days, indicating for each temperature the number of days required for the vaccine titre to fall to half its original level; and
2. the number of days required for the vaccine titre to fall to the minimally acceptable level of 103 per single human dose.

The data obtained indicate that wide differences in the stability of freeze-dried measles vaccines currently exist. At 37°C, half-lives range from 0.62 to 12.2 days, and the time required to reduce the titre to 103 PFU per single human dose ranges from 2.74 to 35.8 days. The best of the vaccines tested should, in the freeze-dried form, be able to withstand exposure to 37°C for 15 to 30 days and to 45°C for four to eight days and still induce immunity, although such storage conditions are hardly to be encouraged.

The use of vaccines with stability characteristics similar to those cited above is recommended in countries in which problems with the cold chain exist. Purchasers of freeze-dried measles vaccines for use in such countries are encouraged to obtain stability data as well as copies of vaccine production and control protocols from the manufacturers.

Source: Wkly Epidem Rec, 46;354,1979.

Editorial Note:
All measles vaccines provided through the EPI Revolving Fund meet or exceed the stability characteristics.

1980

February 1980
Volume II, Number 1

Live Attenuated Measles Vaccine

The fact that live attenuated measles vaccine is manufactured under a number of different brand names often causes problems for program managers in deciding which product to use in the national program. In order to understand how the different brands relate to each other, it is useful to review the history of measles vaccine development.

Over 25 years ago, in 1954, Dr. John Enders succeeded in isolating the measles virus from David Edmonston, an 11 year-old boy from Bethesda, Maryland (USA) who was suffering from measles. After isolating the virus on primary tissue culture, Enders was able to adapt and propagate the virus on chick embryo tissue culture (CE). The CE adapted strain, which was designated EDMONSTON A, proved to be too virulent for vaccine purposes, therefore Enders applied himself to further attenuating the strain. This was done by means of further passages on CE fibroblasts, giving rise to a second-generation attenuated virus which he named EDMONSTON B. Though this was an improvement on its predecessor, it was still too virulent to be applied on a large scale. Further attenuation, therefore, was essential before the vaccine could receive wider acceptance.

Pursuing this need, laboratories continued to pass EDMONSTON B on CE until a third generation of more attenuated strains was finally developed. These latter strains are known by various names, and differ from each other in the number of times the parent strain, EDMONSTON B, was passed on CE. They provide the seeds for the vaccines now commercially available. The relationship among the different strains is shown in the following list:

1. From EDMONSTON B
   a: Seed strain developed on CE fibroblasts:
      - SCHWARZ: 85 passages
      - BECKENHAM:20-71 passages
      - MORATEN: 64 passages
      - MILOVANOVIC: 94 passages
   b: Seed strain developed on primary tissue cultures of different species of animals, including CE, and adapted on Ruman Diploid Wistn 38;
2. At almost the same time as Enders, Smorodintsev in the USSR succeeded in developing on CE a different parent seed known as LENINGRAD 16.

Whether EDMONSTON B or LENINGRAD 16 is used as the seed strain, all vaccine manufacturers prepare the live attenuated measles vaccine by culturing the seed on CE tissue culture, except in the case of Yugoslavia where human diploid tissue culture is used for making vaccines. The measles vaccines supplied through the EPI program in the Americas are all prepared from seeds derived from EDMONSTON B.

Irrespective of their parental lineage, vaccines prepared from the aforementioned strains are very effective, inducing a protective level of HAI antibodies which persists for several years after vaccination. Contrary to what might be expected, a stronger concentration of viral content per vaccination dose does not necessarily prolong immunity. The immunization dose recommended by WHO is a volume of the vaccine which contains not less than 1,000 TCD50.

Though it has been observed that some vaccines are better tolerated than others, one should expect a variable percentage of vaccine recipients to come down with fever for a couple of days within nine or ten days of vaccination. This is by no means uncommon and does not speak against the vaccine.

The stability of the vaccine does not depend on the virus, as there is no major difference between strains with regard to their temperature tolerance. More important, no doubt, are the quality of the lyophilization technique and other factors such as the residual moisture content in the dry vaccine and the use of stabilizers. Various stabilizers have been tested, but because proteins could be allergenic, manufacturers are excluding them from their preparations and putting more reliance on a well-balanced system of buffers.

Source:

1. Krugman S. "Present Status of Measles and Rubella Immunization in the US." J. Pediatrics, 90:1, 1977.
2. Schwartz J, Lingberg C, Yofe Y, and Cockburn WC. "A Comparative Study of Four Live Measles Vaccines in Israel." WHO Bull., 39:285, 1968.

"Vaccines save lives."

April 1980
Volume II, Number 2

Measles in the Region of the Americas, 1978–1979

A total of 261,451 cases of measles were reported to PAHO for 1979 by 28 Member Governments in the Region of the Americas. This figure is 26.5% higher than the 192,132 cases reported by those countries for 1978. Table 1 itemizes by subregions of the Americas the cases reported for 1978 and 1979. Figure 1 illustrates the subregional rates for 1978 and 1979.

The interpretation and comparison of country or subregional data poses certain difficulties due to the different stages of development of the vaccination activities and reporting systems in each country. Despite this limitation, several trends are still discernible in the occurrence and distribution of measles in the Region of the Americas over the last two years.

The greatest increase took place in continental Middle America, and the most notable decrease in the Caribbean.

In North America, while the figures for the subregion as a whole underwent no significant change, a marked difference did emerge in the number of cases reported by each country from one year to the other. In the United States of America there was a 50%t drop in the number of cases reported from 1978 to 1979 (26,795 and 13,448, respectively), whereas in Canada the number of cases reported for those years increased 287% (5,821 and 22,527, respectively).

In six Caribbean countries the number of cases reported for 1979 decreased from the 1978 level. This reduction was most pronounced in the cases of Cuba, Jamaica and Grenada. In the Bahamas, Dominica, and the Dominican Republic, on the other hand, the number of cases reported increased in 1979, especially in the first two countries.

In continental Middle America, the number of cases increased significantly in 1979 in six of the seven countries. Honduras was the only country which showed a reduction from the 1978 level. The greatest increases in numbers of reported cases were in Costa Rica (361 cases in 1978 and 6,883 in 1979) and Mexico (2,933 cases in 1978 and 33,847 in 1979). In Tropical South America there was an overall increase in the number of cases reported from 1978 to 1979. The largest increase was in Guyana, followed by Ecuador, Peru and Paraguay. The figures for the other countries remained unchanged or increased only slightly in 1979.

The rise in the number of cases reported in temperate South America was caused chiefly by the increase in Chile (14,269 cases in 1978 and 34,247 in 1979) and Uruguay (501 and 1,196 cases, respectively). Argentina, however, reported virtually the same number of cases for the two years (9,551 and 9,800, respectively).

FIGURE 1 Morbidity rates for measles (per 100,000 inhabitants), by subregion of the Americas, 1978–1979.

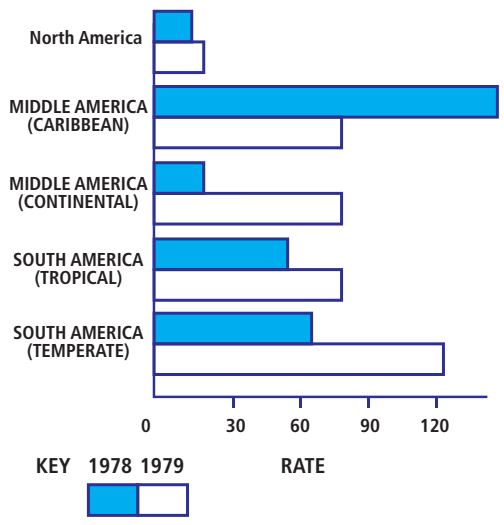


TABLE 1. Reported cases of measles and percentage distribution among subregions in the Americas, 1978-1979.

	Reported cases (percentage distribution)	
Subregion*	1978	1979
North America	32,616 (17.0%)	35,975 (13.8%)
Middle America (Caribbean)	30,920 (16.1%)	17,816 (6.8%)
Middle America (continental)	14,710 (7.7%)	64,947 (24.8%)
South America (tropical zone)	89,565 (46.6%)	97,470 (37.3%)
South America (temperate)	24,321 (12.6%)	45,253 (17.3%)
TOTAL (America's Region)	192,132 (100%)	261,45 (100%)

* North America: Canada and the United States.
Middle America (Caribbean) = Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, and Trinidad and Tobago.
Middle America (continental) = Mexico, Nicaragua, Guatemala, El Salvador, Costa Rica, Honduras, and Panama.
South America (tropical) = Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru and Venezuela. (No 1978-1979 data are available for Suriname, nor are comparable 1978 data available for Bolivia.)
South America (temperate) = Argentina, Chile, and Uruguay.

"When vaccination was suspended in Argentina in 1975, the number of reported measles cases began to increase rapidly."

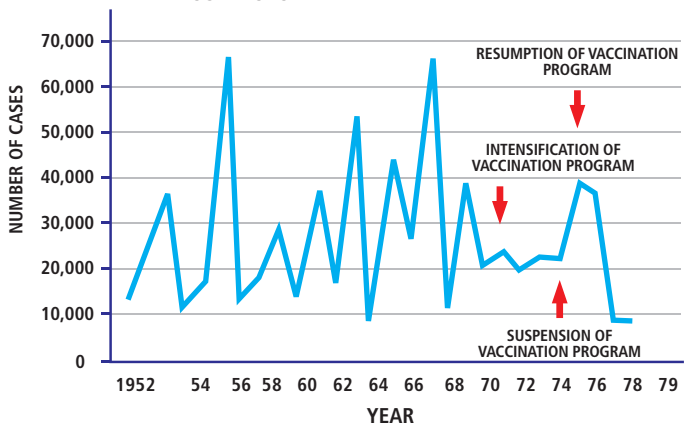
August 1980
Volume II, Number 2

Measles in Argentina: 1952-1979

The epidemiological history of measles in Argentina between 1952 and 1979 is depicted in Figure 1. The trends of the disease during this period clearly reveal three peak epidemic years: 1957, when 66,419 cases were reported; 1964, with 53,018 cases; and 1968, with 66,253 cases. The incidence rates per 100,000 inhabitants for these years were: 337.36 (1957), 238.80 (1964), and 293.0 (1968). The number of cases reported for each year between 1952 and 1979, together with the corresponding incidence rates, can be seen in Table 1.

Vaccination against measles in Argentina was begun in 1965. However, due to low coverage and insufficient quantities of vaccine, the results obtained were not satisfactory. Starting in 1972, with the implementation of Public Health Code No. 19968 and the provision of sufficient quantities of vaccine, Argentina achieved a significant reduction in the number of measles cases reported, as can be seen in Figure 1.

FIGURE 1 Reported measles cases, Republic of Argentina, 1952–1979.



It will be observed in this figure that the epidemic peaks characteristic of the years prior to 1972 disappear during the period 1972-1975, when Argentina was implementing a widespread vaccination program. However, in 1975 Argentina suspended vaccination against measles and the number of cases reported began to increase rapidly. The marked increase in the number of measles cases in 1977 and 1978 provides clear evidence of what happens when vaccination activities are interrupted.

During the second semester of 1976, vaccination activities were resumed in time to blunt the effects of the measles epidemic which was then in course. By 1978, a significant reduction in measles morbidity and mortality had been registered, as is shown in Tables 1 and 2. Between 1976 and 1979, the number of reported measles cases decreased by 76%. The incidence rate for measles dropped in 1978 to the lowest ever obtained 66.8% reduction as compared to 1976.

In 1980, Argentina is implementing the following strategies for providing vaccination against measles:

- routine vaccination programs with periodic intensification of activities.
- massive vaccination in case of outbreaks.
- vaccination of susceptible school-age children, including a proposed resolution that would require a measles vaccination certificate from children entering primary school or kindergarten.

TABLE 1. Measles morbidity in Argentina, 1952–1979.

Year	Number of cases	Incidence rate (per 100,000 inhabitants)
1952	12,731	71.23
1953	26,983	148.12
1954	37,206	200.47
1955	11,796	62.39
1956	17,074	88.50
1957	66,419	337.36
1958	13,855	68.95
1959	18,122	88.50
1960	29,978	143.78
1961	13,102	61.79
1962	37,493	174.06
1963	16,428	75.12
1964	53,018	238.80
1965	9,875	43.80
1966	44,904	196.11
1967	25,715	114.88
1968	66,253	293.0
1969	12,593	54.9
1970	39,222	168.5
1971	20,722	87.6
1972	24,510	101.9
1973	21,423	87.8
1974	23,803	95.7
1975	23,108	90.8
1976	39,291	151.7
1977	36,538	138.5
1978	9,551	35.2
1979	9,986	36.5

TABLE 2. Measles mortality in Argentina, 1970–1978.

Year	No. of deaths	Incidence rate (per 100,000 inhabitants)
1970	1,485	6.38
1976	310	1.19
1977	242	0.93
1978	103	0.38

Source: State Secretariat of Public Health, Republic of Argentina.

Editorial Note:

The data on measles in Argentina illustrate once again the benefits that can be achieved with a good immunization program, while also serving as a reminder of the importance of program continuity. However, it should be noted that the key to controlling measles—as well as all the other EPI diseases—is to plan vaccination services in all areas of a country so that immunization is offered to the target populations on a routine basis. In this way, vaccination coverage is increased with the minimum amount of effort. Argentina deserves congratulations for its efforts to achieve effective control of measles.

October 1980
Volume II, Number 5

Observations on an Outbreak of Measles in Serrana Municipality, São Paulo State, Brazil

During December 1979, the district public health team of the Ribeirão Preto subregion began to be alarmed at the relatively large number of hospitalized measles cases reported among the resident population of Serrana Municipality, one of the 12 towns in the health district.

The first case occurred in November 1979, and the others were reported during December, except for one which was reported in January 1980. The shape of the outbreak is illustrated in the following figure.

FIGURE 1 Number of hospitalized measles cases in November and December 1979 and January 1980. Serrana Municipality, São Paulo State, Brazil.

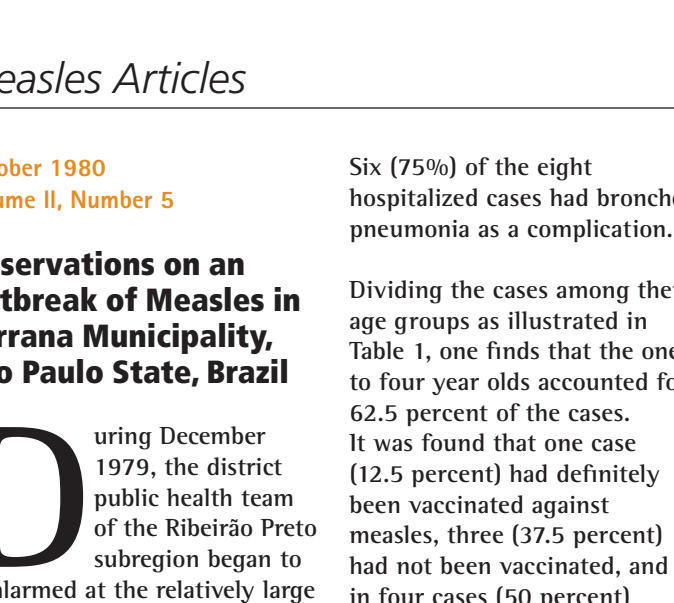


TABLE 1. Hospitalized measles cases reported in November and December 1979 and January 1980 among residents of Serrana Municipality, São Paulo State, Brazil.

Age group	No. of cases	
	Number	%
Under 1 year	1	12.5
1–4 years	5	62.5
5–14 years	2	25.0
Total	8	100.0

Source: Boletim Epidemiológico Semanal and epidemiological records.

TABLE 2. Vaccination history of hospitalized measles cases, by age groups, Serrana Municipality, São Paulo State, Brazil.

Age group	Vaccinated		Not vaccinated		Unknown		Total	
	No.	%	No.	%	No.	%	No.	%
Under 1 year	–	–	–	–	1	12.5	1	12.5
1–4 years	1	12.5	2	25.0	2	25.0	5	62.5
5–14 years	–	–	1	12.5	1	12.5	2	25.0
Total	1	12.5	3	37.5	4	50.0	8	100.0

Source: Boletim Epidemiológico Semanal and epidemiological records.

TABLE 3. Cases of measles occurring in November and December 1979 and January 1980, by age groups, estimated associated populations, and attack rates per 100,000 residents of the town of Serrana, São Paulo, Brazil.

Age group	No. of cases	Estimated population	Attack rate
0–4 years	57	1,189	4.8
5–9 years	56	1,242	4.5
10–14 years	23	1,130	2.0
15 years and older	4	5,096	0.8
Total	140	8,657	1.6

Source: Household epidemiological survey.

Six (75%) of the eight hospitalized cases had broncho-pneumonia as a complication.

Dividing the cases among their age groups as illustrated in Table 1, one finds that the one to four year olds accounted for 62.5 percent of the cases. It was found that one case (12.5 percent) had definitely been vaccinated against measles, three (37.5 percent) had not been vaccinated, and in four cases (50 percent) the vaccination history was unknown. These figures are shown in Table 2.

These data pointed to an outbreak of measles, which warranted an investigation to determine the real situation so that practical and effective control measures could be taken.

TABLE 4. Distribution of cases of measles among infants under one year, by age in months, during the outbreak of measles in late 1979 and January 1980 in the town of Serrana, São Paulo State.

Age	No. of cases	%
1 month	–	–
2 months	–	–
3 months	–	–
4 months	1	12.5
5 months	–	–
6 months	2	25.0
7 months	–	–
8 months	–	–
9 months	3	37.5
10 months	1	12.5
11 months	1	12.5
Total	8	100.0

The period studied comprised the months of November and December 1979 and up to the 28th day of January 1980. The survey of the occurrence of cases in the community consisted of a single house-to-house inquiry about cases of measles and other pertinent data for the period in question.

It was found at the outset that seven of the eight measles cases hospitalized during those months came from the same quarter in the town of Serrana: the one most distant from the center and inhabitated by the poorest members of the community.

Table 3 illustrates the distribution of the measles cases discovered, by age group, and the attack rates based on the estimated population.

The ages in months of the cases among infants under one year of age are given in Table 4.

It will be noted that three of the eight cases (37.5 percent) were infants under nine months of age, and eight of the 140 cases (5.7%) were under one year of age.

Among the 140 cases there were three deaths from measles, which gave a case fatality rate of 2.1% and a mortality rate of 34.7 per 100,000 inhabitants. One of the deaths was of an infant under one year of age and were in the 1 to 4 year group. No deaths occurred among the hospitalized patients.

The age distribution of the cases is given in Figure 2, which shows the number of cases at each year of age. The Figure shows that the age group most heavily attacked was that of children between 1 and 8 years old. This does not bear out the conventional wisdom that children between the ages of 18 and 30 months are the most frequently attacked in measles epidemics, particularly among the more indigent populations, as was the case in Serrana. However, the outbreak occurred during the summer months, which is not surprising in hot areas where the disease is endemic.

In the survey to detect cases among the population, an attempt was made to discover the measles vaccination history of each individual; the results are presented in Table 5. As can be seen, the proportion of measles cases among vaccinated individuals was relatively high (17.1%). In 68.6% of the cases the patient had not been vaccinated, and in 14.3% the vaccination history was unknown.

A more detailed study was performed in order to correlate the ages at which the patients had been vaccinated against measles and the ages at which they contracted the disease.

The results are given in Table 6. Roughly speaking, four cases may be disregarded because they were vaccinated at the same age at which they contracted measles—one at 9 months, one at 1 year and two at 2 years of age. Since the precise dates on which they were vaccinated and on which they contracted the disease are unknown, it cannot be reliably determined whether the infection emerged before the vaccination could confer immunity (assuming, of course, that the vaccine administered was potent).

Disregarding the four cases who caught measles at the same age at which they were vaccinated, there remain 14 cases out of 20 (70%) who were vaccinated at the age of seven months or younger and who then contracted the disease.

The vaccination coverage was found to be adequate in the one-to-four year age group, but inadequate—in those under one year of age and low in the five- to-fourteen year age group. This can be seen in Table 7 which illustrates the results of a survey among 726 inhabitants of the area of the town at highest risk of infection.

The survey data in Table 7 on children under one year of age diverge markedly from the data on children in the same age group vaccinated during 1979 in the entire population, according to information of the

FIGURE 2 Number of measles cases, by age in years, which occurred in the city of Serrana, Sáo Paulo State, Brazil, during the months of November and December 1979 and January 1980. Total: 140 cases.

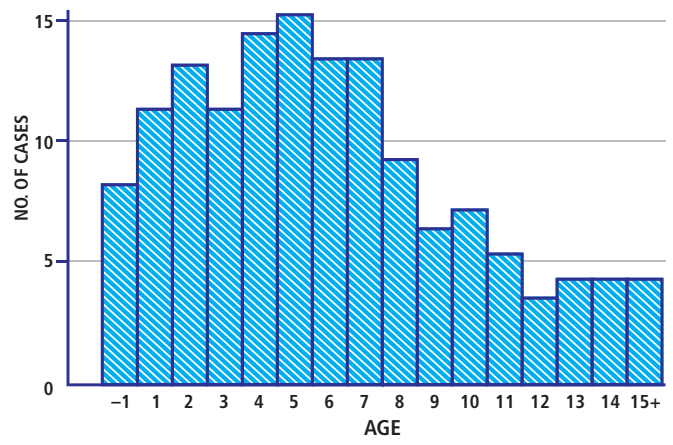


TABLE 5. Vaccination history of measles cases occurring in November and December 1979 and January 1980, by age group, among residents of Serrana Municipality, São Paulo State.

Age	Vaccination history						Total	
	Yes		No		Unknown			
	No.	%	No.	%	No.	%	No.	%
Under 1 year	1	0.7	5	3.6	2	1.4	8	5.7
1 year	2	1.4	9	6.4	–	–	11	7.9
2 years	5	3.5	7	5.0	1	0.7	13	9.3
3 years	1	0.7	8	5.7	2	1.4	11	7.9
4 years	4	2.9	7	5.0	3	2.1	14	10.0
5 years	4	2.9	7	5.0	4	2.9	15	10.7
6 years	2	1.4	8	5.7	3	2.1	13	9.3
7 years	4	2.9	7	5.0	2	1.4	13	9.3
8 years	–	–	8	5.7	1	0.7	9	6.4
9 years	1	0.7	5	3.6	–	–	6	4.3
10 years	–	–	7	5.0	–	–	7	5.0
11 years	–	–	5	3.6	–	–	5	3.6
12 years	–	–	1	0.7	2	1.4	3	2.1
13 years	–	–	4	2.9	–	–	4	2.9
14 years	–	–	4	2.9	–	–	4	2.9
15 years or more	–	–	4	2.9	–	–	4	2.9
Total	24	17.1	96	68.6	20	14.3	140	100.0

Source: Household epidemiological survey.

TABLE 6. Comparison between age of vaccination against measles and age at which the disease was subsequently contracted. Cases during November and December 1979 and January 1980. Serrana, São Paulo State, Brazil.

Age at onset of symptoms	Age at the time of vaccination																	
	2 months		6 months		7 months		8 months		9 months		10 months		1 year		2 years		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
9 months	-	-	-	-	-	-	-	-	1	4.2	-	-	-	-	-	-	1	4.2
1 year	-	-	-	-	-	-	-	-	1	4.2	-	-	1	4.2			2	8.3
2 years	-	-	-	-	3	12.5	-	-	-	-	-	-	-	-	2	8.3	5	20.8
3 years	-	-	-	-	1	4.2	-	-	-	-	-	-	-	-	-	-	1	4.2
4 years	-	-	1	4.2	3	12.5	-	-	-	-	-	-	-	-	-	-	4	16.7
5 years	-	-	2	8.3	2	8.3	-	-	-	-	-	-	-	-	-	-	4	16.7
6 years	-	-	-	-	1	4.2	-	-	-	-	-	-	1	4.2	-	-	2	8.3
7 years	1	4.2	-	-	-	-	1	4.2	-	-	1	4.2	1	4.2	-	-	4	16.7
8 years	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9 years	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4.2	1	4.2
10 years or more	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1	4.2	3	12.5	10	41.7	1	4.2	2	8.3	1	4.2	3	12.5	3	12.5	24	100.0

Source: Household epidemiological survey.

TABLE 7. Coverage of measles vaccination in a sample of residents of the highest risk area in Serrana, São Paulo State, Brazil, January 1980.

Age group	Population studied	No. vaccinated			
		First dose	%	Booster	%
Less than 1 year	12	4	33.3	-	-
1–4 years	88	59	67.0	11	12.5
4–14 years	211	34	16.1	2	0.9
15 years or more	415	0	-	0	-
Total	726	97	13.4	13	1.8

Source: Household investigation.

TABLE 8. Monthly measles vaccination coverage of children under one year of age* during 1979 in Serrana, São Paulo State. Population officially estimated at 219 children.

Month	No. vaccinated	Cumulative %
January	10	4.6
February	18	12.8
March	24	23.7
April	19	32.4
May	18	40.6
June	25	52.0
July	38	69.4
August	28	82.2
September	32	96.8
October	29	110.0
November	46	131.0
December	25	142.5
Total	312	142.5
Monthly average	26	11.9

*Vaccination performed beginning at seven months of age.
Source: Vaccination records of the local health unit.

TABLE 9. Distribution of first dose and booster shot of measles vaccine administered, by age group, between 17 and 28 January 1980 in Serrana, São Paulo State, Brazil.

Age group	First dose		Booster	
	No.	%	No.	%
Less than 1 year*	36	30,5	-	-
1–4 years	70	59,3	58	48,3
5–14 years	12	10,2	62	51,7
Total	118	100,0	120	100,0

* Beginning at seven months of age.
Source: Records of the local health unit.

local health unit as presented in Table 8.

According to the previous table, the vaccination coverage of children under 1 year of age was excellent, even having exceeded the officially estimated population in the age group. This excess may be accounted for by the influx of immigrants from rural areas in the neighboring states of Minas Gerais and Paraná, attracted by extensive cane plantations and a large sugar mill operating in the area.

In any event, it is clear that a substantial part of the population under 1 year of age residing in the measles outbreak area under consideration did not receive the preventive care offered by the Secretariat of Health. Actually, such pockets of unvaccinated residents of poor urban areas are not uncommon even in highly developed countries, as has been well documented in the literature.

In view of a clearly epidemic situation, the district health team decided to intensify its vaccination against measles particularly among the population regarded as being at highest risk by the standards of the Epidemiological Surveillance System of the State Secretariat for Health. Susceptible children between seven months and 5 years of age were vaccinated and booster shots were given to individuals between one and 14 years of age, as shown in Table 9.

Of the 238 doses of vaccine administered, 122 (51.3%) were given on the premises of the local health unit and 116 (48.7 percent) in epidemiological fieldwork.

The percentage of unvaccinated individuals in the Ribeirão Preto region remains high for two reasons: measles vaccination was only recently begun (in 1971) and its administration has been predominantly static. Moreover, until 1979, all children 7 months and older were given only one dose. At the end of 1979, this practice was modified to include the administration of a booster shot, beginning at 15 months of age, to all children who had received their first dose before reaching one year of age.

Source: Germano Neto, J., public health physician, Technical Director; Freitas S.B., public health nurse; and Santos, M.T., public health educator, all of Ribeirão Preto, Health District, São Paulo, February 1980.

Editorial Note:

A study to determine the optimum age for measles vaccination is in progress under the auspices of PAHO/WHO and four Latin American countries, including Brazil (see Boletim Epidemiológico XI (14), 1979). This study is necessary because, unlike temperate-zone countries where hereditary immunity is retained for up to 1 year or slightly longer after birth, in tropical countries it is lost earlier.

Source: Boletim Epidemiológico XII(5}:42-51, 1980 published by the Fundaçao de Serviços de Saúde Pública, Ministério da Saúde, Brasil.

October 1980
Volume II, Number 5

Measles: United States, First 39 Weeks of 1980

As of 27 September 1980 (the 39th reporting week), investigations by immunization project[1] staff revealed only one active chain of transmission[2] of measles in the United States. Projects in 15 other counties throughout the country reported isolated cases that were not associated with documented spread (Figure 1).

FIGURE 1 U.S. Counties* with measles, week ending 27 September 1980.

*In CALIFORNIA: Contro Costa, Glenn, Imperial, Los Angeles, San Diego, San Francisco, and Tulare counties; FLORIDA: Broward and Pinellas counties; ILLINOIS; Mclean; MISSOURI: Gentry; NEW YORK: Kings; OHIO: Columbiana; TEXAS: Harris and Uvalde; VIRGINIA: Warren; WISCONSIN: Marathon.

The single outbreak, which began 9 September and is still being investigated, occurred in Warren County, Virginia. The index patient was a 15-year-old girl, who had been exposed to the disease in England. A rash developed after she returned to Virginia on 9 September. Four of her siblings subsequently had onset of measles from 18-21 September. An additional 27 suspected cases—all in persons attending the same private day school in Rappahannock County—are being investigated in five contiguous counties.

Nationwide, 12,881 cases of measles were reported for the first 39 weeks of this year. This is second only to last year's total (12,207) as being the lowest ever recorded for a comparable period. Actually, the incidence of measles this year has been lower than in 1979 for all periods except 23 March-12 July (weeks 13-29, Figure 2).

For 9 of the last 11 weeks, the reported numbers of cases have been record lows, and the 23 cases reported in week 39 were the fewest ever reported for a single week.

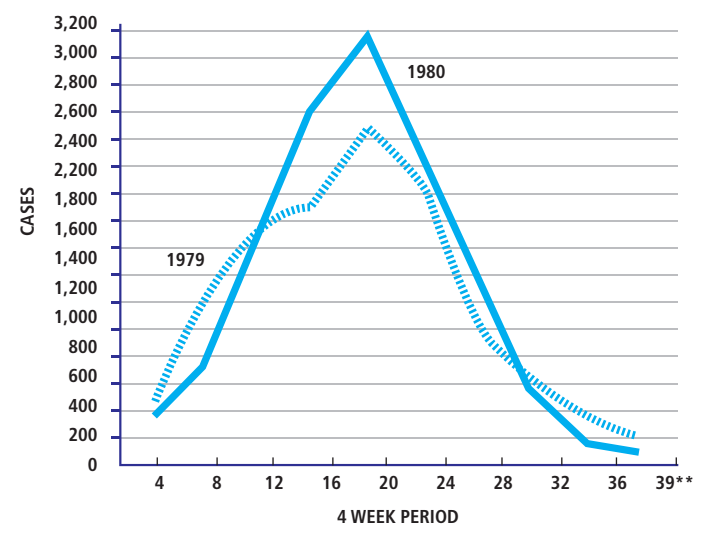
Thirty-one States and the District of Columbia have not reported any measles cases in the last four weeks. Since 1 January 1980, 41 states and the District of Columbia have not reported any cases of measles for at least a 4-week period. Only Arizona, California, Florida, Illinois, Minnesota, New York, Ohio, Texas, Wisconsin, and New York City have not had as many as four consecutive measles-free weeks this year.

During the first 39 weeks of 1980, 20 states had a measles incidence of >10/100,000 among persons <18 years old, whereas 24 stales reported such rates in 1979. Thus far in 1980, nine states have reported a measles incidence of <1/100.000, as did only five states in the same period last year.

Reported by H.S. Wood, MO, G.A. Dengel, MD, P.O. Pedersen, MD, Warren County Health Dept; J. Einardon, MD, Rappahannock County, Virginia; G. Hiller, MD, State Epidemiologist, Virginia State Dept. of Health; and Immunization Div., Bur. of State Services. CDC.

Source: Morbidity and Morlality Weekly Report 29(40): 501-502, 1980. Centers for Disease Control, Public Health Service, Atlanta. Georgia.

FIGURE 2 Reported measles cases, by 4-week period, 1979–1980.*



*Through the 39th reporting week.
**3-week period.

1 State or local health jurisdictions which have been awarded federal funding for immunization programs.
2 An active chain of transmission is one in which there are two or more epidemiologically linked cases, and less than four weeks has elapsed since onset of rash in the last known case.

Editorial Note:

The record low numbers of reported cases of measles in recent weeks and the fact that there is only one known active chain of transmission in the United States indicate that transmission of measles has been interrupted throughout most of the country. Intensive measles outbreak control efforts are thus even more important in the few areas still reporting measles. Prompt attention should be paid to reports of isolated cases since they may develop into continuing outbreaks. An integral part of measles outbreak control programs should be the exclusion of students who do not have valid evidence of measles immunity not only from the schools reporting measles cases, but also from other schools in the area that are at risk of measles introduction.[3]

3 MMWR 27:427-430, 435-437, 1980.

December 1980
Volume II, Number 6

Measles Vaccine Efficacy: United States

From July 1978 through October 1979, 24 of 63 Immunization Project Areas[1] voluntarily supplied the Centers for Disease Control (CDC) in Atlanta, Georgia with detailed information on their reported measles cases. This included such data as vaccination status (where known), complications of the disease, and means of diagnosis. During this 16-month period, the following nine project areas submitted such information on more than 80% of the cases that they had reported to the MMWR:[2] Colorado, Kentucky, Louisiana, New Jersey, New Mexico, Massachusetts, North Dakota, Ohio, and Utah. Five other project areas maintained this level of reporting for shorter periods ranging from 3 to 10 months: Arizona, Iowa, Missouri, Virginia, and Washington. During this interval, 18,755 cases of measles were reported from all sources to the MMWR; the more detailed information was obtained on 2,480 (13.2%) cases from the project areas. Of these 2,480 cases, 1,901 (77.0%) originated from the above-named states. The remainder of this report will focus exclusively on these 1,901 cases.

A history of vaccination status was available for 1,669 (88.0%) cases, and 869 of these (52.0%) gave a history of measles vaccination. Documented proof from personal, school, or clinic records of adequate[3] vaccination was obtained from 434 (26.0%) of the 1,669 patients. An undocumented history of adequate vaccination was elicited from an additional 163 (10.0%) cases. Another 197 (12.0%) were judged to be inadequately vaccinated and 75 (4.0%) were not classifiable. Of the 1,669 cases, 800 (48.0%) indicated no prior receipt of measles vaccine.

Editorial Note:

Because a substantial percentage of measles cases have adequate vaccination histories, concern has been raised about vaccine efficacy--both initial and -. Vaccine efficacy cannot be evaluated by simply determining the percentage of reported cases with vaccine histories; underlying vaccination levels must be considered. Vaccine efficacy is calculated in the following manner:

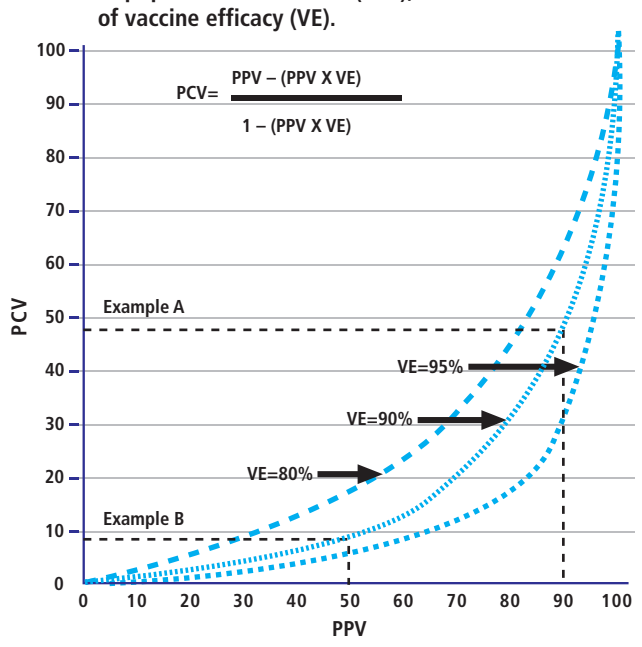
$$\text{Vaccine efficacy (VE)} = \frac{\text{Attack rate in unvccinated} - \text{Attack rate in vaccinated}}{\text{Attack rate in unvaccinated}} \times 100\%$$

This equation can be rewritten to express the percentage of cases vaccinated (PCV) in terms of the percentage of the population vaccinated (PPV) and vaccine efficacy (VE); thus,

$$\text{PCV} = \frac{\text{PPV} - (\text{PPV} \times \text{VE})}{1 - (\text{PPV} \times \text{VE})}$$

By knowing two of these variables, the third can be calculated.

FIGURE 1 Percentage of cases vaccinated (PCV: per percentage of population vaccinated (PPV), for three values of vaccine efficacy (VE).



Reported by Surveillance and Assessment Br., Immunization Div., Bur. of State Services, and Field Services Div., Bur. of Epidemiology, CDC.

Figure 1 shows three of a family of curves which can be generated from the above equation, each for a different assumed vaccine efficacy. These curves predict the theoretical proportion of cases that will have vaccine history in the event of an outbreak. The curves do not predict the occurrence of an outbreak in any given set of circumstances, but rather the expected proportional distribution of cases should an outbreak occur. For example, if a measles epidemic is observed in a population with homogeneous measles exposure where 90% of the individuals are vaccinated (PPV = 90%) with a 90% effective vaccine (VE 90%), the expected percentage of vaccinated cases would be 47% (PCV = 47%; Example A, Figure 1). If only 50% were vaccinated, then 9% of the cases would be expected to have a history of vaccination (Example B). For a given vaccine efficacy, the percentage of cases vaccinated should increase as the percentage of the population that is vaccinated increases.

Most recent clinical trials have shown a measles vaccine efficacy of 90% or better.[4] In the above article, the 12% of cases with histories of vaccination which, under inspection, proved to be inadequate underlines the need to evaluate vaccination histories thoroughly.

Source: Morbiditv and Mortality Weekly Report 29(39): 470-472, 1980. Center for Disease Control, Public Health Service, Atlanta, Georgia.

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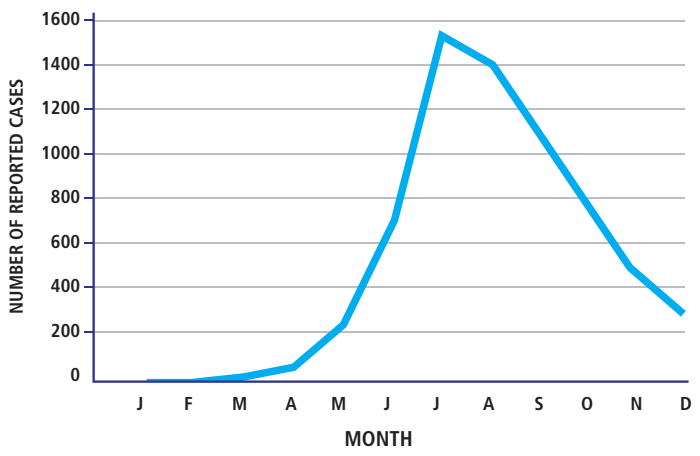
1 State or local health jurisdictions which have been awarded federal funding for immunization programs.
2 "Morbidity and Mortality Weekly Report," published by the Center for Disease Control.
3 Histories of vaccination were considered adequate if the vaccination occurred after 12 months of age and was with live, further-attenuated vaccine alone, with Edmonston B vaccine with gamma globulin, or with any measles vaccine after 1968.

MAP 1 Health Regions of Costa Rica

FIGURE 1 Measles cases notified by month, Costa Rica, 1979.



was discovered in the northern part of the country in August 1979, and at the end of the year the number of cases reported in the southern area increased.

Figure 1 shows the distribution of cases by month.

The majority of cases reported in April occurred among schoolchildren. Epidemiological investigation showed that many of these children had not been vaccinated and that they had been in contact with Nicaraguan children who had measles. This situation changed rapidly and soon children under one year of age constituted the most affected group. Up to then, measles vaccine had been administered at one year of age. Starting in May, vaccination was begun at six months of age.

Table 1 presents the total number of measles cases; reported in Costa Rica in 1979, together with the percentage distribution and rate for each age group.

Of the 1,413 cases in infants less than 1 year old, 312 occurred in the age group from 0 to 5 months old (equivalent to a rate of 9.2 per 1,000 inhabitants) and 1,101 in the group from 6 to 11 months old (a rate of 31.5 per 1,000).

Of the 31 deaths registered, 13 occurred without medical assistance, six of them (three infant of 3 months, a child of 11 years, and two adults) in an Americn Indian population in southern Costa Rica. Table 2 shows case fatality rates in different age groups.

1981

February 1981
Volume III, Number 1

Measles: Costa Rica, 1979

In 1979, 6,601 cases of measles, including 31 deaths, were reported in Costa Rica; this is equivalent to a morbidity rate of 3.1 per 1,000 and a case fatality rate of 0.46%.

In the years 1976, 1977, and 1978, the total numbers of cases reported were 1,664, 1,972, and 347, respectively.

All five health regions of the country reported cases in 1979. Region 1, which includes the city, had the largest number of cases (3,263) and highest morbidity rate (4.3 per 1,000).

The outbreak began in the central part of the country (Region 1), which is more urban, and spread toward the Pacific area (see Map 1). A focus

TABLE 1. Reported cases of measles, by age group, Costa Rica, 1979.

Age group	Number of cases reported	Percentage	Rate per 1,000 inhabitants
Less than 1 year	1,413	21.4	20.5
1 year	1,217	18.4	19.0
2 years	573	8.7	9.7
3 years	387	5.9	7.0
4 years	296	4.5	5.6
5–9 years	1,088	16.5	3.3
10–14 years	733	11.1	2.3
15 years or more	894	13.5	0.8
Total	**6,606**	**100.0**	**3.1**

TABLE 2. Measles rates of death by age group, Costa Rica, 1979.

Age group	No. of deaths	Case fatality rate
0–5 months	6	1.92%
6–11 months	5	0.45%
Less than 1 year	11	0.77%
1 year	14	1.15%
2 years	1	0.17%
3–9 years	-	-
10–14 years	1	0.13%
15 years or more	4	0.44%
Total	**31**	

On the basis of the case studies, it was concluded that 75% of the children who contracted the disease had not been vaccinated, while 25% of them had, most of them at 1 year of age.

During 1978 and 1979, surveys were done to determine the levels of coverage achieved in Costa Rica. The surveys were done in Regions 1 and 2 in 1978, and in Region 1 in 1979 (during the first months of the year). The results indicated that 73% of the 1 year olds had been vaccinated against measles and rubella in 1978, and 68% in 1979.

Costa Rica reported a total of 1,000 cases of measles in 1980, which is almost a seven-fold decrease from the same period in 1979, when 6,833 cases were reported.

Source: Ministry of Health, Department of Epidemiological Surveillance, Costa Rica, 1980.

February 1981
Volume III, Number 1

Argentina: Compulsory Presentation of Measles Vaccination Certificate for Admission to Primary and Pre-primary School

By Resolution No. 3845/80 of the Ministries of Social Welfare and of Culture and Education, presentation of the meas1es vaccination certificate has been made compulsory for admission to primary and pre-primary school.

Exempt from this obligation are children who have had measles, for whom a medical certificate to that effect must be presented.

The measles vaccination will be performed in accordance with current health standards by the competent health authority (whether national, provincial, municipal), which will issue the appropriate certificate.

Whenever the epidemiological situation makes it advisable to do so, the health authority may order the vaccination of susceptible children who entered school before the resolution went into effect, or revaccination if the circumstances warrant. This vaccination or revaccination may also be performed on school premises in a coordinated operation of the health and education areas.

The provisions of this resolution also apply in the primary and pre-primary schools functioning under the Ministry of Culture and Education. The provinces, the national territory of Tierra del Fuego, Antarctica and the South Atlantic Islands, and Buenos Aires municipality may join the system under agreements to be signed through the Ministries of Social Welfare and of Culture and Education for purposes of implementing the resolution in public and private schools in their jurisdictions.

The preamble to the resolution states that measles is a major health problem in the country because of its extensive contribution to infant morbidity and mortality, that vaccination programs and campaigns have not yet attained the expected epidemiological results for total control of the disease, and that the magnitude of the harm to children warrants extraordinary measures to consolidate the benefits obtained.

"Ensuring that the child is immune on admission to school." it states, "guarantees that the spread of the disease in schools is will be avoided, and there with the repercussions that would ensue for the family and the community at risk." The preamble adds that "it is the duty of the health and education authorities to provide the means for protecting the population from preventable diseases."

The resolution complements the health measures taken by the State Secretariat for Public Health which, in intensified measles vaccination campaigns since 1976, have been able to reduce the incidence of the disease to the lowest levels known in the country in the last decade.

Source: Boletín del Día, No. 1985. Ministry of Social Welfare, Republic of Argentina, 26 Januarv, 1981.

April 1981
Volume III, Number 2

Measles in the United States

For 34 consecutive weeks, fewer than 100 measles cases per week have been reported for the United States. The number reported per week in this period has ranged from 13, an all-time low for any given week, to 88, and has averaged 44 cases per week.

For the first 14 weeks of 1981, a total of 778 cases have been reported. This represents an 80% decrease from the 3,897 cases reported for the same period in 1980 (Table 1).

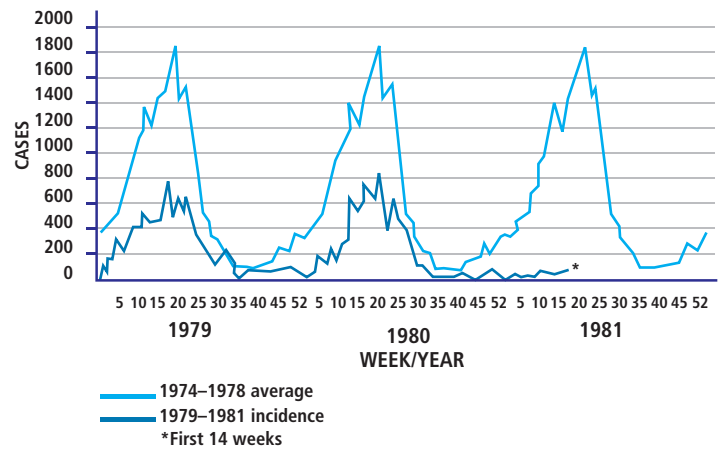
TABLE 1. Measles in the United States, April 1981.

Year	Week 14	Weeks 1–14
1981	82	778
1980	578	3,897
1970	1,976	16,702
1960	19,197	166,930

Reported by Surveillance and Assessment Br. Immunization Div., Center for Prevention Services, Centers for Disease Control, Atlanta, Ga., U.S.A.

Source: Morbidity and Mortality Weekly Report 30(15): 182-183, 24 April 1981.

FIGURE 1 Measles incidence, United States, 1979–1981, and 1974–1979 average.



Editorial Note:
This extended period of low measles activity is unprecedented in the United States. The previous record low period was in 1979 when for 12 consecutive weeks fewer than 100 measles cases per week were reported. If present trends continue, fewer than 3,000 measles cases will be reported in 1981, an average of less than one case per county. Particularly striking through week l4 of 1981 is the absence of the expected seasonal increase in numbers of reported cases of measles (Figure 1). Thus, the current nationwide Measles Elimination Program appears to have brought about dramatic reductions in measles incidence and to have altered one of the characteristic features of the epidemiology of measles in the United States.

April 1981
Volume 3, Number 2

Measles in Costa Rica, 1980

Following the 1979 outbreak of measles in Costa Rica (see *EPI Bulletin,* Vol. III, No.1), the incidence of measles dropped to endemic levels. However the Atlantic region, one of those least affected during 1979, with 143 cases per 100,000 inhabitants, was the scene of an outbreak in 1980 in the area of Guácimo and Pococí. These two cantons reported a combined total of more than 200 cases, or 20% of the national total, for a rate of 445 per 100,000 inhabitants.

Table 1 presents data on the different regions and the rates per 100,000 inhabitants.

The pattern of age distribution by regions, as shown in Table 2.

As can be seen in Table 3, the frequency is still highest among infants under 1 year of age. Since there are no cases in infants under 6 months, the specific rate is double.

The norm for measles immunization in Costa Rica is to vaccinate children against measles at 6 months of age and to administer another dose against measles-rubella one year later.

Source: Semana Epidemio1ógica, Epidemiological Division, Ministry of Health, Costa Rica, Vol. 9, No.5, 31 January 1981.

TABLE 3. Number of measles cases by age group and specific rate per 100,000 inhabitants, Costa Rica, 1980.

Age group	No. of cases	Specific rate/1,000
<1 year	252	3.6
1 year	180	2.8
2–4 years	193	1.6
>4 years	327	0.2

TABLE 1. Reported cases of measles and rates per 100,000 inhabitants, by region, Costa Rica, 1980.

Region	No. of cases	Rate/100,000 inhabitants
Central	298	40.0
Huetar North	135	26.8
Chorotega	86	27.2
Huetar Atlantic	325	90.3
Brunca	128	63.7
Total	972	45.7

TABLE 2. Reported cases of measles, by region and age group. Costa Rica, 1980.

Region	Age group					
	< 1 year	1 year	2–4 years	> 4 years	Unknown	Total
Central	100	44	47	99	99	298
Huetar North	37	24	24	50	-	135
Chorotega	22	19	14	27	4	86
Huetar Atlantic	66	68	89	94	–	325
Brunca	27	25	19	57	-	128
Total	252	180	193	327	20	972

April 1981
Volume III, Number 2

Epidemic Outbreak of Measles in Three Central Provinces of Chile

Vaccination against measles has been systematically practiced in Chile since 1964. Nationwide coverage has been satisfactory, reaching 81 percent of infants. Vaccination is indicated at the age of eight months, and is confined to a single dose.

Mortality has declined remarkably, from 3,264 deaths when the program was launched (a rate of 38.6 per 100,000), to only five deaths in 1977 and 55 in 1978. However, morbidity and mortality took a sudden upturn in 1978 and rose steeply through 1979 (See Table l), during which year the number of deaths tripled to a total of 154. These deaths were associated with an epidemic that struck with varying intensity in different parts of the country and was of considerable magnitude in the Maule region, which consists of the provinces of Talca, Curicó and Linares, with mainly rural populations.

The epidemic outbreak began in the second ha1f of 1978 and continued through 1979, reaching its severest intensity in the second half of that year. The highest number of cases was 1,196 (a rate at 1,338.2) which was recorded in an area of Linares-Maule Province (the communes at Parral, Cauquenes and Chanco, with a total population of 89,777), the smallest in the region.

In regard to age distribution, 10.9% of the cases were infants under 1 year and 10.1 percent were children 1 to 2 years old. The 2-5-year age group accounted for 26 percent of the cases, giving an average distribution per age cohort of 8.5%; the 6-14 year age group accounted for 39%, giving an average of 4.9% per age cohort.

Table 1. Morbidity from measles. Number of cases and rates per 100,000 inhabitants. Chile, Region VII and its provinces, 1977–1979.

Year	Country	Rate	VII Region		Rate
1977	1,062	10.0	25		4.1
1978	15,381	141.7	609		86.1
1979	34,573	316.7	3,403		558.3
Year	**Curicó**	**Rate**	**Rate**	**Linares**	**Rate**
1977	7	4.0	2.4	11	4.6
1978	331	187.3	80.4	45	18.7
1979	777	443.1	351.8	1,621	679.9

The most frequent complications were bronchopneumonia, laryngotracheitis, tracheitis and other lesser conditions. Of the total number of patients reported, 39.3% required hospitalization in Curicó. 19.2 percent in Talca, and 22.6% in Linares-Cauquenes. There were no deaths.

It is interesting to note that a sizable proportion of the children who fell ill had previously been vaccinated, as shown in Table 2.

To appreciate the true significance of these figures, cohorts must be studied on the basis of their age and year of vaccination.

This apparent failure of the vaccination programs should be analyzed in relation to the following possible factors:

a) Low levels of vaccination coverage in previous years, which placed sizable populations at risk and increased the number of susceptible individuals from year to year. (See Table 3)
b) Detective preservation of the vaccine, largely in regard to refrigeration during shipment and subsequent storage.
c) Defective vaccination technique (use of alcohol, inaccurate dosages, etc.).
d) Deficient immune response in the individual.

This situation, which coincides with an epidemic increase in the incidence of measles throughout the country during 1978 and 1979, has prompted the authorities to review carefully all the stages of the cold chain; they have requested additional resources and are subjecting vaccines to an on-going potency control.

Source: Dr. Jorge Toro A., Ministry of Health, and Mrs. María Machuca R., Regional Nurse, Region VIIi in Boletín de Vigilancia Epidemiológica, Ministry of Health. Republic of Chile, Vol. VII. No. 7-8. July-August 1980.

TABLE 2. Number of measles cases, according to vaccination history, Region VII.

Vaccination history	Curicó		Talca		Linares		Cauquenes	
	No.	%	No.	%	No.	%	No.	%
Vaccinated	53	54.0	197	63.4	...		135	33.5
Not Vaccinated	32	32.9	32	10.6	...		110	27.3
Unknown	12	10.3	80	25.9	...		158	39.2
Total	97	100.0	309	99.9			403	100.0

... Data not available.

TABLE 3. Measles vaccination coverage, by year, Region VII, 1969–1979.

Year	8-11 months		
	No. scheduled	No. administered	%
1969	27,695	20,117	72.6
1970	15,555	10,471	67.3
1971	16,545	10,577	63.9
1972	15,620	8,099	51.9
1973	15,820	8,577	54.2
1974	16,138	13,629	84.5
1975	14,350	12,864	89.6
1976	14,264	12,758	89.4
1977	14,360	14,436	100.5
1978	14,912	14,686	98.5
1979	14,278	15,061	105.5

October 1981
Volume III, Number 5

The Epidemiology of Measles in the State of Rio Grande do Sul, Brazil

The incidence of measles in Rio Grande do Sul over the last decade is illustrated in Figure 1. The effectiveness of the case-reporting system may be judged from the parallelism between the curves for incidence and mortality in recent years.

Regular measles vaccination in the health units of the Secretariat for Health and the Environment began in 1973. The launching of this activity was followed by a sharp drop in the number of cases. Today, however, despite coverages of about 80% in many municipalities, incidence remains high.

In 1980, 12,424 cases were reported, an increase of 19.25 percent over the previous year, but still short of the epidemic threshold calculated for the period.

Mortality rates, while keeping pace with the trend of morbidity, definitely account for only part of all the deaths from measles. Many of these deaths are still reported as resulting from one or another of the complications of the disease—bronchopneumonia, encephalitis, etc.—which shows that more care must be taken to fill out death certificates correctly.

Seasonal Variation

Cases of measles can turn up at any time of the year, but epidemics usually break out at the end of winter. In Figure 2, which shows the distribution of cases in Rio Grande do Sul by month of onset, it can be seen that these numbers peak during the months of late winter and early spring.

Age Distribution

An analysis of the age distribution of measles cases in two different periods (1974-77 and 1978-80) shows that the incidence was highest among children under 5 years old and, within this group, the risk of contracting the disease was high in the age subgroup of children from 6 to 12 months old. This risk decreased with increasing age (Table 1).

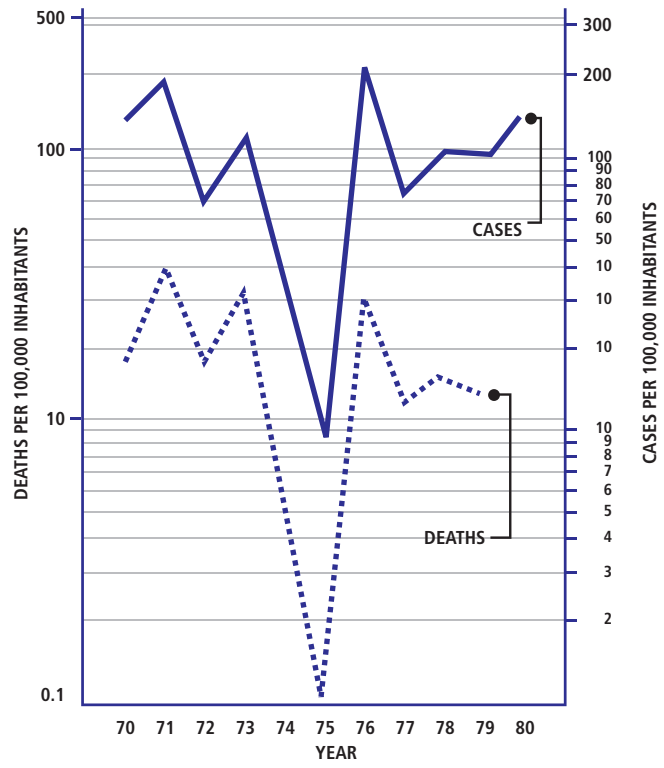
It can be seen that in each of the two periods considered, more than half of the cases—53.3% in 1974-77 and 52.3% in 1978-80—were of children under 5 years of age, which makes this group the priority target population in any intensive vaccination effort (Table 2).

Vaccination Coverage

The coverage of children under 1 year of age who are vaccinated annually is on the increase having reached 75.6 percent in 1980 (Figure 3).

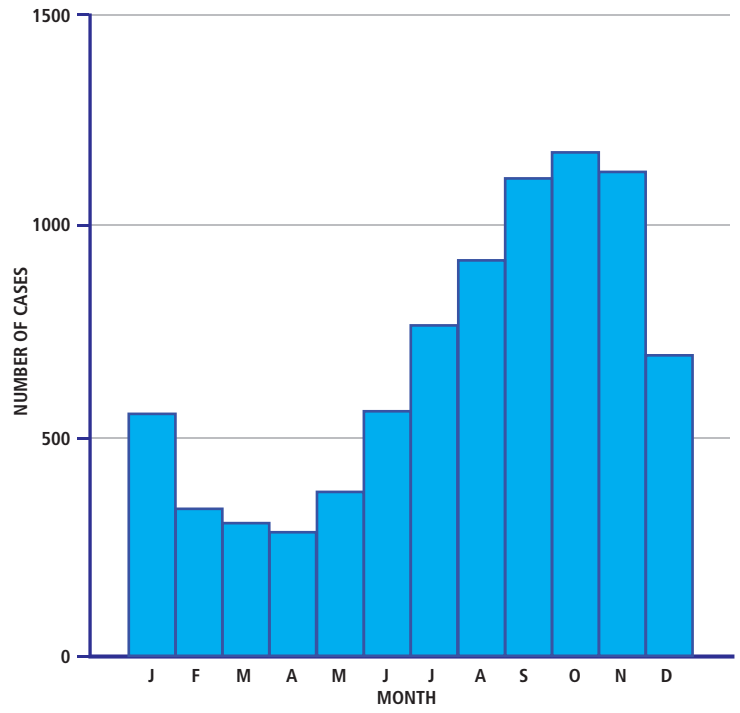
While vaccination coverage of the population under 1

FIGURE 1 Rates of incidence (per 100,000 population) and mortality from measles. Rio Grande do Sul, Brazil, 1970-80.



Source: Epidemiological Surveillance Unit, SSMA.

FIGURE 2 Mean number of measles cases, by month of onset. Rio Grande do Sul, Brazil, 1975-80.



Source: Epidemiological Surveillance Unit, SSMA.

TABLE 1. Measles incidence per 100,000 inhabitants, by age group. Rio Grande do Sul, 1974-1977 and 1978-80 (mean period).

Age group	Mean number of cases		Mean incidence	
	1974–77	1978–80	1974–77	1978–80
0-5 months	128	196	136.5	194.3
6-8 months	269	424	536.2	837.3
9-11 months	251	368	546.2	726.7
Less than 1 year	**648**	**989**	**345.7**	**488.1**
1-4 years	2,736	3,564	351.7	423.4
5-9 years	1,514	2,096	148.4	189.6
10-14 years	726	1,077	76.7	104.9
15 years and older	491	978	10.7	19.5
Total	**6,121**	**8,705**	**81.1**	**106.4**

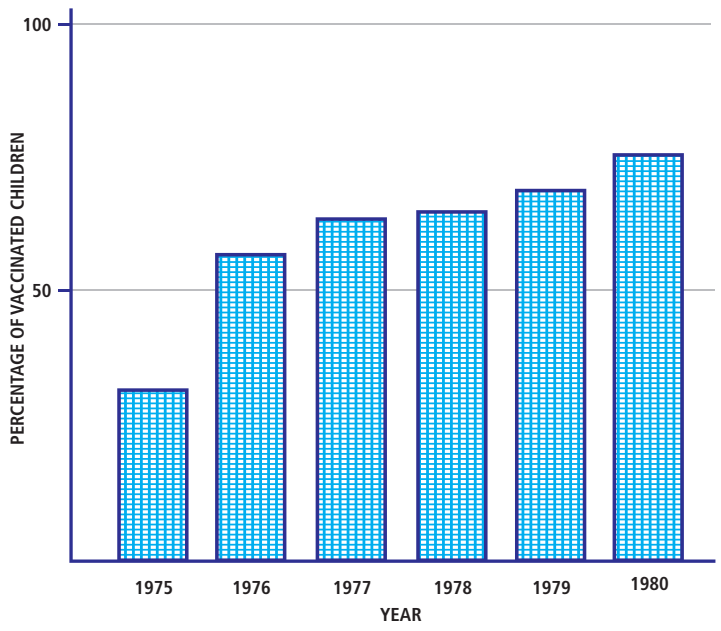
Source: Epidemiological Surveillance Unit, SSMA.

TABLE 2. Mean number of measles cases and percentage distribution, by age group. Rio Grande do Sul, 1974-77 and 1978-80.

Age group	1974-77			1978-80		
	Mean no. of cases	%	Cumul. %	Mean no. of cases	%	Cumul. %
0-11 months	648	10.6	10.6	939	11.4	11.4
1-4 years	2,736	44.7	53.3	3,564	40.9	52.3
5-9 years	1,514	24.7	80	2,096	24.1	76.4
10-14 years	726	11.9	91.9	1,077	12.4	88.8
15 years and older	491	8.1	100.0	978	11.2	100.0
Total	**6,121**	**100.0**	**–**	**8,705**	**100.0**	**–**

Source: Epidemiological Surveillance Unit, SSMA.

FIGURE 3 Measles vaccination coverage of population under 1 year of age. Rio Grande do Sul, Brazil. 1975-80.



Source: Epidemiological Surveillance Unit, SSMA.

year of age has reached 75% overall, this is not the situation everywhere in the state, as many municipalities have not yet reached this average.

Moreover, even in municipalities where coverage is high, unprotected foci persist (the inhabitants on the outskirts of large cities and scattered rural populations), and the incidence of measles remains high. This makes it necessary to step up measles vaccination, within the framework of comprehensive health care, with coverage of the population under 5 years of age as the objective. Only in this way can measles incidence and mortality be lowered to minimal levels and the risk of epidemics be removed.

Source: Informe Epidemiológico, Secretariat of Health and Environment. State of Rio Grande do Sul, Brazil, January 1981.

December 1981
Volume III, Number 6

United States: Measles Importations from the Americas

In the 21-month period 30 December 1979 through 10 October 1981 (week 1 of 1980 through week 40 of 1981), 190 cases of measles were reported[1] to have been imported into the United States from 42 different countries worldwide. A case is considered to be imported if a person has onset of rash within 15 days of arriving in the United States from a foreign country.

These cases represent 1.2% of the provisional total of 16,202 cases of measles reported to the Centers for Disease Control (CDC) during that period. An average of two measles importations were reported each week without distinct seasonal variation (Figure 1). The proportion of measles cases reported as being imported increased from 0.7% (95/13,506) in 1980 to 3.5% (95/2,696) during the first 40 weeks of 1981. The number of importations per week averaged 1.8 in 1980 and 2.4 in 1981.

Of the 190 persons with imported measles, 82 (43.2 percent) were travelers who arrived in the United States from 13 different countries in the Western Hemisphere (Table 1). The proportion of imported measles cases arriving from the Americas has increased from 35.8% (34/95) in 1980 to 50.5% (48/95) during the first 40 weeks of 1981.

Travelers arriving from three countries accounted for 75.6% (62) of the importations from the Americas: Mexico 38 (46.3%), Canada 15 (18.3 percent), and Venezuela 9 (11.0%). Ten other countries each contributed four or less importations during the 21-month period.

Returning U.S. citizens (vs. foreign nationals) have begun to account for an increasing proportion of all measles importations (worldwide). In 1980, 33 (34.7%) of 95 imported measles cases were among U.S. citizens, compared with 58 (61.1%) of 95 importations reported the first 40 weeks of 1981. A similar increase has been observed in U.S. citizen importations from the Americas. In 1980, 17 (50.0 percent) of 34 measles importations from the Americas were among U.S. citizens, compared with 31 (64.6 percent) of 48 such importations reported during the first 40 weeks of 1981.

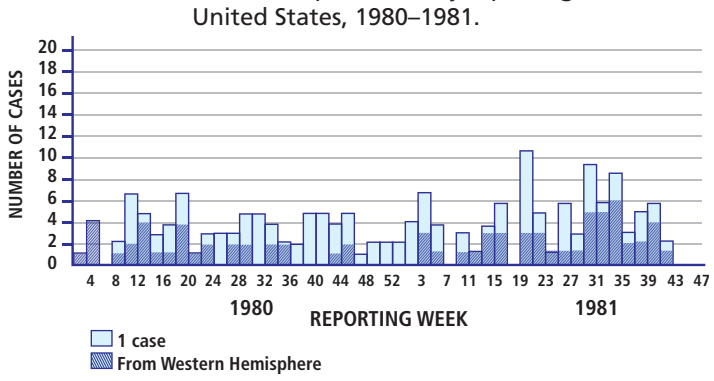
Of 190 importations from around the world, immunity status was determined for 108 persons, of whom 59 (54.6%) were U.S. citizens and 49 (45.4%) were foreign nationals. Of these 108 persons, 14 U.S. citizens and 18 foreign nationals at least 15 months of age and born after 1956 had no evidence of measles immunity. Measles immunity consists of either documented physician-diagnosed measles or receipt of live measles vaccine on or after the first birthday. These 32 cases (29.6%) could probably have been prevented had the persons been vaccinated. The remaining 76 (70.4%) cases would have been difficult to prevent by use of the current recommendations for measles vaccine in the U.S. Fifty persons were less than 15 months of age, the age when measles vaccine is routinely recommended in the U.S., and 12 persons were born before 1957 and would generally have been thought to be immune. Finally, 14 persons had adequate documentation of measles vaccination with live vaccine on or after the first birthday or of physician-diagnosed measles disease. The immunity status of 82 (43.2%) of the 190 persons who had imported measles (worldwide) is not known.

Transmission of measles to other persons in the United States was documented for 49 (25.8%) of the total 190 importations, and for 22 (26.8%) of 82 measles importations from the Americas. Measles outbreaks occurred in Arkansas,[2] Florida, and New York[3] following these importations. However, in most other instances transmission was limited.

TABLE 1. Measles importations into the United States from other American countries. 30 December 1979-10 October 1981.

Country	Number of importations	%
Mexico	38	46.3
Canada	15	18.3
Venezuela	9	11.0
Dominican Republic	4	4.9
Jamaica	4	4.9
Trinidad	3	3.8
Bahamas	2	2.4
Honduras	2	2.4
Argentina	1	1.2
Barbados	1	1.2
Colombia	1	1.2
Guyana	1	1.2
Nicaragua	1	1.2
Total	82	100.0

FIGURE 1 Measles importation, by reporting week. United States, 1980–1981.



Editorial Note:

A national effort is underway to eliminate indigenous measles from the United States by 1 October 1982.[4] In 1962, the year before measles vaccine was licensed, 481,530 cases of measles were reported to CDC, compared with 13,506 in 1980, a decrease of 97.2%. During the first 40 weeks of 1981, only 2,696 cases were reported. Measles encephalitis and deaths have also decreased. As the incidence of indigenous measles decreases, imported measles will be increasingly recognized as a problem in the United States.[5]

Measles importations are a continuing source of reported measles cases in the United States. In the 21-month period discussed here, the substantial decline in total measles cases led to a rise in the proportion of imported measles cases. The risk of measles from foreign sources appears to be low and relatively constant throughout the year.

The proportion of imported measles cases arriving from Western Hemisphere countries increased during the 21-month period. Two countries sharing land borders with the United States-Canada and Mexico-accounted for the majority of these importations. This may reflect the sizable movement of persons between the United States and those countries. A rising proportion of imported cases occurred among returning U.S. citizens.

Every state in the United States requires that a child have proof of measles immunity before entering school, consisting of a written record at the time he/she is enrolled.[6] Therefore, children who enter the United States and plan to enroll in school should be vaccinated against measles (unless contraindicated) and retain written documentation. It is suggested that children who do not plan to enroll in school (e.g., tourists, preschoolers) also have documentation of measles immunity before entering the United States.

Source: Amler RW, Bloch AB, Orenstein WA, Bart KJ, Turner PM Jr, Hinman AR. Immunization Division, Center for Prevention Services, Centers for Disease Control, U.S. Public Health Service, Department of Health and Human Services, Atlanta, Georgia 30333 (USA).

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1982

February 1982
Volume IV, Number 1

Measles in the Americas, 1971-1980: A 10-Year Review

Only a few of the hemisphere's countries were able to reduce their annual measles mortality to less than one death per 100,000 population during the 1970s. That reduction was the goal for measles control in the Ten-Year Health Plan for the Americas, which came to an end last year.

Information on the annual occurrence of measles cases during the 1970s was received from 30 to 32 of the countries in the Americas, depending on the year. The total number of cases reported annually ranged from 177,178 in 1975 to 313,512 in 1971, with a mean of 254,161 cases.

Measles incidence in the Americas ranged from a high of 169.4 cases per 100,000 population in 1977 in the Middle American Caribbean to a low of 10.4 cases in 1974

in continental Middle America (Figure 1).

Though the magnitudes of the incidences and the years varied, the Middle American Caribbean and tropical and temperate South America showed increased incidence patterns every two to three years. continental Middle America exhibited larger variations in incidence between peak years, with low-incidence periods of three to four years, and Northern America had a five-year interval between major rises in incidence.

A total of 101,807 measles deaths were reported in the Americas during the decade (Figure 2). Annual mortality reporting was incomplete for this period; depending on the year, mortality figures were received from 19 to 24 of the 32 countries in the Americas from 1971 through 1978. Reports for 1979 covered four countries.

Northern America was the only region to have reported measles mortalities below the Ten-Year Health Plan goal during the entire period. The Middle American Caribbean region had a low of 0.7 in 1978 and a high of 1.8 in 1976. Temperate South America experienced mortality increases every two to three years; its low mortality years (1972, 1975, and 1977) were below the Ten-Year Health Plan objective. The highest mortalities were reported from continental Middle America and tropical South America.

Countries reporting mortalities of less than 1.0 per 100,000 population during the entire period were the Bahamas, Barbados, Canada, Cuba, and the United States.

Table 1 shows the age distribution of reported measles cases and deaths and age-specific mortalities per 100,000 population by region. Information on age distribution came from 31 countries and represented 157 country-years of measles experience. In all regions except Northern America the highest proportion of cases occurred in the 1- to 4-year age group; in Northern America the highest proportion of cases occurred in the 5- to 9-year group.

In all regions except temperate South America the highest proportion of deaths occurred in the 1- to 4-year group. In temperate South America infants under 1 year represented the highest proportion of measles deaths.

In all regions, there was an inverse relationship between age and age-specific mortality, with the highest age-specific mortalities seen in infants less than 1 year old. These data support the need to immunize such infants.

Information on patient vaccination histories was seldom available. Table 2 is a review of patients' vaccination histories during outbreaks in three countries. The percentage of patients who had been vaccinated ranged from a low of 10.5% in Panama to a high of 63.8% in Talca, Chile.

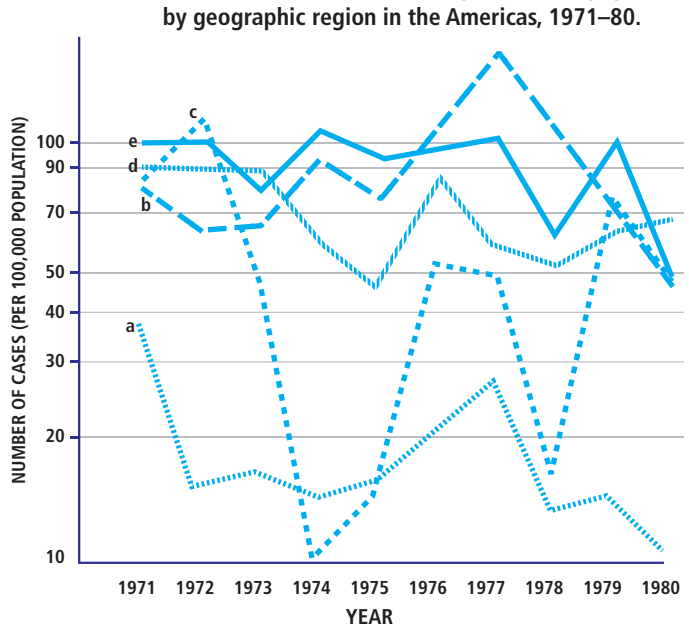
The high proportion of measles in vaccinated patients in Chile did not in itself reflect failure of the vaccine, but illustrated the need to ascertain data required to calculate actual vaccine efficacy during outbreaks.

TABLE 1. Age distribution of reported measles cases and deaths and age-specific mortality by geographic region in the Americas, 1971-80.*

Age groups (in years)	North America			Middle America						South America					
				Caribbean			Continental			Tropical			Temperate		
	% of total cases	% of deaths	No. of deaths per 100,000 pop.	% of total cases	% of deaths	No. of deaths per 100,000 pop.	% of total cases	% of deaths	No. of deaths per 100,000 pop.	% of total cases	% of deaths	No. of deaths per 100,000 pop.	% of total cases	% of deaths	No. of deaths per 100,000 pop.
Less than 1	5.0	19.8	0.195	10.8	25.8	13.895	13.2	21.6	70.653	16.0	23.9	75.044	13.1	45.4	32.113
1-4	16.1	36.6	0.088	48.6	61.5	7.540	54.3	58.0	52.809	54.3	62.7	54.080	38.5	42.9	7.868
5-9	32.1	15.4	0.027	25.1	9.1	0.879	23.4	13.6	11.286	20.8	10.4	7.913	30.1	6.7	1.049
10-14	29.8	13.9	0.021	10.1	2.2	0.238	5.8	3.7	3.605	5.3	1.9	1.639	11.8	2.4	0.382
15-19	14.0	4.4	0.007	2.9	0.3	0.041	1.5	1.2	1.483	1.9	0.5	0.491	3.6	1.0	0.172
20 or older	2.9	9.9	0.002	2.5	1.1	0.028	1.8	1.8	0.547	1.6	0.6	0.146	2.9	1.6	0.045
Total	99.9	100.0	0.015	100.0	100.0	1.372	100.0	99.9	12.766	99.9	100.0	11.357	100.0	100.0	1.656

*Where the ages were reported as unknown, the age distribution of the known data was calculated, and the cases were distributed accordingly.

FIGURE 1 Annual incidence of measles (per 100,000 population) by geographic region in the Americas, 1971–80.



a. Northern America: Canada and the United States.
b. Caribbean Middle America: the Bahamas, Barbados, Cuba, Dominica, the Dominican Republic, Grenada, Haiti, Jamaica, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago.
c. Continental Middle America: Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama.
d. Tropical South America: Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, and Venezuela.
e. Temperate South America: Argentina, Chile, and Uruguay.

FIGURE 2 Measles mortality (per 100,000 population) by geographic region in the Americas, 1971-80.

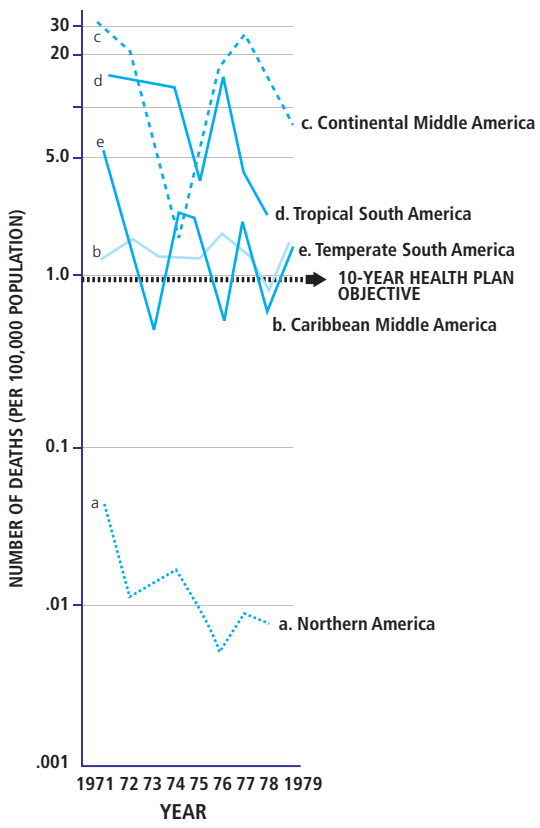


TABLE 2: Vaccination history of measles cases during outbreaks in three countries.

Country (years)	Vaccinated		Unvaccinated		Unknown	
	No.	%	No.	%	No.	%
Chile (1978-79) Curicó	53	54.6	32	33.0	12	12.4
Talca	197	63.8	32	10.4	80	25.9
Canquenes	135	33.5	110	27.3	158	39.2
Brazil (Nov. 1979-Jan.1980)	24	17.1	96	68.6	20	14.3
Panama (1978)	11	10.5	56	53.3	38	36.2

February 1982
Volume IV, Number 1

New Brunswick Is First Canadian Province to Pass Compulsory Immunization Law

New Brunswick is the first Canadian province to pass legislation requiring proof of immunization as a condition for school entry. Starting with the 1982 school year, children entering the province's school system for the first time will have to show proof of immunization or a documented history of natural infection by certain diseases as a condition for admission.

Proof of immunization will be required against diphtheria, tetanus, poliomyelitis, measles, mumps, and rubella. Exemptions will be granted in cases where vaccination is contraindicated and for children whose parents have a personal or philosophical objection to vaccination.

This legislation was passed under the Schools Act and supported by legislation under the Health Act. All 50 states in the United States have similar legislation.

Source: Dr. C. Devadason, Director, Communicable Disease Control, Department of Health, New Brunswick, Canada.

February 1982
Volume IV, Number 1

International Measles Immunization Symposium

An international symposium on measles immunization will take place from 16 to 19 March at PAHO Headquarters in Washington. The symposium is sponsored by the Fogarty International Center of the U.S. National Institutes of Health and several bilateral and multilateral agencies, including PAHO and WHO.

Symposium participants will gauge the impact of measles in the world today, paying particular attention to the status of immunization programs in countries with and without special vaccination programs. They will also discuss the characteristics of currently available measles vaccines, assess the impact and success of measles control efforts, and evaluate prospects for future control. Special attention will be given to strategies for attaining high immunization coverage in various parts of the world, and subjects in measles epidemiology and control requiring further research will be identified.

More than 200 experts from all over the world are expected to attend the symposium. They will include public health officials, epidemiologists, program managers, vaccine manufacturers, and research scientists. All EPI program managers in the Americas will receive invitations to attend.

The symposium's proceedings will be published and readers will be advised as soon as they are available.

August 1982
Volume IV, Number 4

Measles Complications in Children Under 2 Years of Age

In Bangladesh a retrospective study of the mid-term complications resulting from a measles outbreak in children under 2 years of age was carried out by the International Centre for Diarrhoeal Disease Research (ICDDR). The outbreak occurred in the rural area of Matlab in March-April 1980 and complications were investigated five months later.

At the time of their occurrence, cases were identified by field assistants who had no formal medical training. A sample of the identified cases was verified by the resident doctors of Matlab who showed a 99% correlation with the identifications by the field assistants.

Of the 2,219 measles cases in the epidemic, 763 (34.4%) occurred in children under 2 years of age. A 10% sample of these (75 cases) was chosen for the study. Controls without measles (matched for age and residence) were chosen from available data gathered by the ICDDR's comprehensive Demographic Surveillance System, which covers 149 villages with a total population of about 180,000.

The mean duration of the disease was 7.5 days with a standard deviation of 3.9 days. Of the 75 cases, 31 occurred in children under 6 months of age, 19 in children 6-12 months of age, 16 in children 13-18 months of age, and 10 in children 19-24 months of age. The youngest case occurred in a child 67 days old.

Fifty-two of the 75 cases (69%) had at least one of the complications classically associated with measles. Children who had a rash lasting less than seven days had more complications than those who had measles for longer. There were significant associations between the duration of rash and difficulty in respiration, ear discharges, length of diarrhea, and conjunctival dryness.

Children under 1 year of age developed significantly more complications than those between 1 and 2 years of age. Complications were highest in the 7-12 month age group. The one death among the 75 cases occurred in a 23 month-old child and was caused by dehydration due to diarrhea.

There were significant differences between the cases and the controls in the frequency of coughs, difficulty in respiration, conjunctival dryness and the presence of mucoid, bloody or other type of diarrhea. The conjunctival dryness was directly related to the incidence and duration of diarrhea.

The complications most often mentioned were as follows: difficulty in respiration (28% of cases); ear discharge (16%); various types of diarrhoea (92%); and conjuctival dryness (21%).

In light of these findings, further areas for research were identified, such as an examination of the interaction of nutrition and measles, the effect of measles in terms of weight loss and vitamin A levels, and socio-cultural attitudes towards measles in Bangladesh.

Source: Glimpse (Newsletter of the International Centre for Diarrhoeal Disease Research, Bangladesh) 3(12):1-3, 1981.

December 1982
Volume IV, Number 6

Measles Surveillance United States: Imported Cases, First 26 Weeks, 1982

In the first 26 weeks of 1982, 64 imported measles cases were reported in travelers (U.S. citizens and foreign nationals) who arrived in the United States from 22 different countries worldwide. A measles case is considered to be imported if a person has onset of rash within 18 days of arrival in the United States from a foreign country.

These cases represent 7.2% of the provisional total of 895 cases of measles reported to the Centers for Disease Control (CDC) during the 26-week period, an increase from 0.7% (95/13,506) for the entire year 1980 and 3.6% (110/3,032) for all of 1981. An average of 2.5 measles importations was reported each week (range 0-5) compared with 1.8 in 1980 and 2.4 in 1981.

Returning U.S. citizens have accounted for a rising proportion of imported measles cases-65.6% (42/64) in the first 26 weeks of 1982, compared with 57.9% (66/114) in 1981 and 34.7% (33/95) in 1980. United States citizens accounted for 85.7% (12/14) of the importations which were reported in travelers from Western Hemisphere nations.

Of the 64 persons with imported measles, 32 (50 percent) were travelers who arrived in the United States from three countries: Great Britain (13), Mexico (10), and India (9) (See Table 1). Only 14 (21.9 percent) arrived from countries in the Western Hemisphere. This was a decrease from the 35.8 percent (34/95) reported in 1980 and the 50.0% (57/114) reported in 1981.[1]

Of the 64 imported measles cases, transmission to other persons in the United States (import-associated cases) was documented for 12 (18.8%), of which only one case was from the Americas. Importations and import-associated cases accounted for 25.5% (228/895) of measles cases provisionally reported in the United States during the first half of 1982.

Histories of prior measles vaccination or prior measles illness were available for 69.0% (29/42) of the U.S. citizens and 40.9% (9/22) of the foreign nationals with imported measles. Their histories were reviewed to determine the number of imported measles cases which potentially might have been prevented through adherence to current vaccine recommendations in the United States. A case was considered preventable* if the traveler was at least 16 months of age and born after 1956, and lacked documentation of administration of live measles vaccine on or after the first birthday or a history of physician-diagnosed measles illness.

Only 4 (9.5%) cases occurring in U.S. citizens were potentially preventable; of these only 2 (4.8%) persons would have been accessible to school-based immunization requirements- the major element of measles control in the United States. However, one of those two cases was the index case for an outbreak of 89 measles cases in New York state. Of the 22 cases occurring in foreign nationals, 5 (22.7%) were potentially preventable; of these 3 (13.6%) were old enough to attend school in the United States, and might have been accessible to state immunization laws if they planned to enroll in school while in the United States.

TABLE 1. Imported measles cases: Countries of origin, first 26 weeks of 1982.

Continent and country of origin	US Citizens	Foreign nationals	Total	%
EUROPE	17	10	27	42.2
Great Britain	6	7	13	20.3
Spain	5	-	5	7.8
France	3	-	3	4.7
Switzerland	2	-	2	3.1
Finland	-	1	1	1.6
German Federal Republic	-	1	1	1.6
Sweden	-	1	1	1.6
USSR	1	-	1	1.6
ASIA	12	9	21	32.8
India	5	4	9	14.1
Philipines	3	2	5	7.8
Rep. of Korea	2	1	3	4.7
Israel	1	1	2	3.1
Afghanistan	-	1	1	1.6
Hong Kong	1	-	1	1.6
THE AMERICAS	12	2	14	21.9
Mexico	9	1	10	15.3
Canada	1	-	1	1.6
Colombia	1	-	1	1.6
El Salvador	1	-	1	1.6
Jamaica	-	1	1	1.6
AFRICA	-	1	1	1.6
Egypt	-	1	-	1.6
OCEANIA	1	-	1	1.6
Australia	1	-	1	1.6
TOTAL	42	22	64	100

Discussion

Measles incidence rates continue to decline in the United States. In 1981, a record low of 3,124 cases (1.4 cases per 100,000 population of all ages) was reported. The 895 cases provisionally reported during the first 26 weeks of 1982 represent an additional 60 percent decrease from the same period in 1981.[2] More current data (through week 37 of 1982) show that this trend has continued, with only 1,230 measles cases provisionally reported. The projected annual incidence rate for 1982 is approximately 0.7 cases per 100,000 total population, a new record. Improvements in the investigation of measles cases have made it possible to link epidemiologically over 25% of reported cases to sources outside the U.S.

Classification of travelers by age, citizenship, and immunity status[3] has shown that prevention of their cases was not always possible by adherence to current measles vaccination recommendations.[4] Although most imported cases occurred in U.S. citizens who had travelled abroad, less than 10 percent of the cases in U.S. citizens were potentially preventable. To minimize importations among U.S. citizens, travelers should be immune to measles before they leave the U.S.

Although there are currently no vaccination requirements for entry into the United States, efforts are underway to alert foreign travelers (and agencies sponsoring foreign exchange students) to the advisability of measles vaccination for those who lack documentation of measles immunity. Children who enter the United States and plan to enroll in school must be vaccinated against measles unless contraindicated and must retain documentation to that effect, because all states require that a child be immune to measles before entering school. It is recommended that children who do not plan to enroll in school (e.g., tourists, preschoolers) also be immune to measles before entering the United States.

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1. Amler RW, Block AB, Orenstein A, Bart KJ, Turner PM, Hinman AR. Measles Importations from the Americas, EPI Newsletter 111(6):5-6, 1981.
2. Centers for Disease Control. Measles-United States, first 26 weeks, 1982. Morbidity Mortality Weekly Report 31:381-2, 1982.
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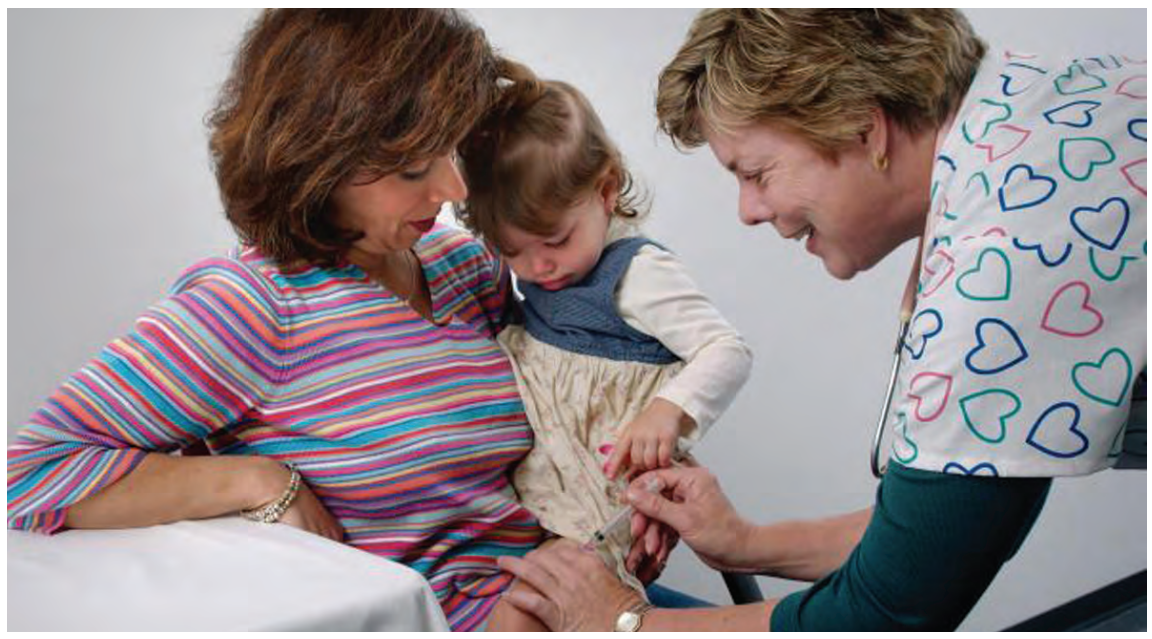
4. Immunization Practices Advisory Committee. Measles prevention. Morbidity Mortality Weekly Report 31:217-24,229-31, 1982.

Source: Turner PM jr., Amler RW, Orenstein WA. Immunization Division, Center for Prevention Services, U.S. Public Health Services, Department of Health and Public Health Service, Atlanta, Georgia 30333 (USA).

*Subsequent to this study, CDC has modified the definition of a preventable case as follows: A preventable case is defined as measles illness occurring in a person at least 16 months of age and born after 1956, who lacks adequate evidence of immunity (live vaccine administration on or after the first birthday, or a history of physician-diagnosed measles illness), and who does not have a medical contraindication to receiving vaccine nor any religious or philosophical exemption under state law.



1983

April 1983
Volume V, Number 2

EPI Global Advisory Group Meeting 1982

The fifth meeting of the Expanded Program on Immunization Global Advisory Group took place 18-22 October 1982 at the WHO Regional Office for Africa in Brazzaville, Republic of the Congo. The following is a summary of the conclusions and recommendations made by the Group.

Global

Continued progress has been achieved in the development of the EPI country, regional and global levels. Information relating to immunization coverage and to the incidence of the target diseases has improved (Figure 1), and activities relating to training and evaluation have increased. Little progress has been seen in the assessment of the program at the regional level in Europe, however, and this should be remedied without delay.

Despite the progress noted above, the Group emphasized that only a short time-eight years-remains in which to accomplish the EPI goals, and stressed that action is urgently needed to implement the Five-Point Action Program endorsed by the World Health Assembly in 1982 in resolution WHA35.31 (See *EPI Newsletter* Vol. IV, No.2).

The Global Advisory Group notes with concern that Point Three of the EPI Action Program, calling for increased financial resources, is not reflected in all Regions in the WHO Regular Budget proposals for 1984-85.

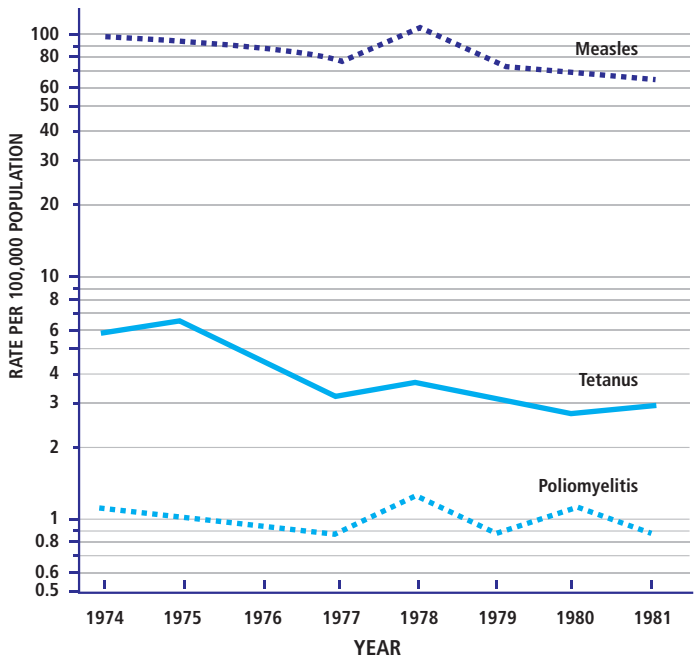
Vaccine Contraindications

The Group noted the following:

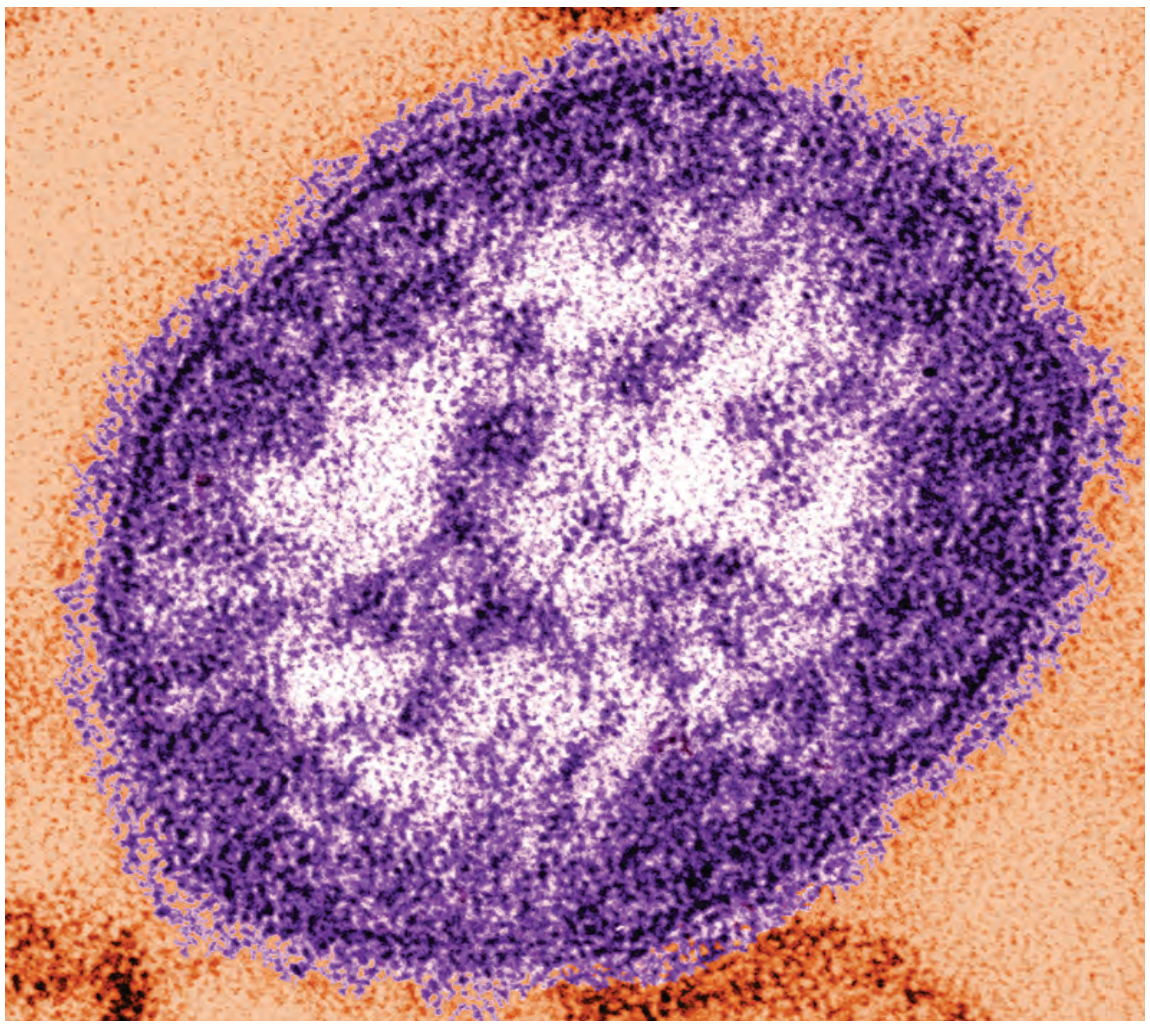
1) The risks of adverse reactions following administration of EPI vaccines are low.
2) The slight increase in risk inherent in the use of vaccines in ill children must be balanced against the dangers involved in leaving such children unimmunized. The practice of immunizing infants presenting with minor illnesses is already accepted in many countries with various levels of socio-economic development.
3) It is particularly important to consider the immunization of ill or malnourished children under the following circumstances:

- where living conditions favor a high incidence and severity of the target diseases, particularly among children during the first 18 months of life;
- where access to health services is limited;
- where immunization coverage is low;
- where children are most likely to come into contact with the health services only during periods of illness;
- where attendance at health facilities is, in itself, an important factor in the spread of infectious diseases of childhood, particularly measles;
- where a refusal to immunize is likely to result in the child not being brought back for further immunizations.

FIGURE 1 World: Reported incidence rates per 100,000 population for measles, tetanus, and poliomyelitis, 1974–1981.*



*There are disease which are expected to be among the most accurately diagnosed and reported, and the most influenced in the short term by immunization programs. Yet their diagnosis and reporting remain major problems in many countries, and is premature to conclude that any decline such as that reported through 1981 for measles is real or that it reflects the start of a long-term trend.



This thin-section transmission electron micrograph (TEM) revealed the ultrastructural appearance of a single virus particle, or "virion," of measles virus. The measles virus is a paramyxovirus, of the genus Morbillivirus. It is 100-200 nm in diameter, with a core of single-stranded RNA, and is closely related to the rinderpest and canine distemper viruses. Two membrane envelope proteins are important in pathogenesis. They are the F (fusion) protein, which is responsible for fusion of virus and host cell membranes, viral penetration, and hemolysis, and the H (hemagglutinin) protein, which is responsible for adsorption of virus to cells.

There is only one antigenic type of measles virus. Although studies have documented changes in the H glycoprotein, these changes do not appear to be epidemiologically important (i.e., no change in vaccine efficacy has been observed).

The Group concluded that health workers should use every opportunity to immunize eligible children. The great majority of children attending health facilities are suffering from minor illnesses, frequently combined with malnutrition, and should be considered eligible for immunization. Individual national advisory groups should decide on the eligibility of children who are more severely ill in the light of the above criteria.

Measles

The goal of the EPI is the control of measles along with other target diseases. Those countries, particularly in the European Region, in which adequate economic and operational resources exist, should be encouraged to undertake complete measles control or eventual eradication.

Research into the operational aspects of measles control should be pursued. Such research should include strategies to change the behavioral patterns of the public and of those working in the field of public health in order to increase acceptance of measles immunization. Research to investigate the potential use of aerosol measles vaccine in the future should be encouraged.

Program Reviews

Substantial progress has been achieved in developing and implementing the EPI review methodology. In these reviews, plans, procedures, and techniques at all levels of the health services are examined and actual results at community level are measured.

The use of multidisciplinary teams composed of national and international staff has lent itself particularly well to strengthening of coordination of various health and related programs within the country. It has also promoted collaboration between staff concerned with immunization and other elements of maternal and child health and primary health care.

The EPI should continue to collaborate with other programs in conducting joint national reviews. Yet, some cautions are appropriate:

- The protocols now available are intended only as checklists and should be amended as needed to fit the objectives of the particular review in which they are to be used.
- The EPI cluster sampling method to estimate immunization coverage is not necessarily valid for assessing other items now included in community level questionnaires.
- Reviews which are too broad in scope will lose their effectiveness; the information obtained should be limited to that required for decision-making.
- Criteria of managerial effectiveness should be further developed for all levels within countries.

Similar program reviews should be promoted for other elements of primary health care. In some cases, this may require further development of indicators, targets, and valid methods to assess program effectiveness and impact at the community level.

Community participation in evaluation should be encouraged. Community members can help to design and carry out evaluations and can help to analyze their results.

Health Education/ Community Participation

A number of examples of successful initiatives resulting in increased community participation in immunization programs exist, but much remains to be done in this field.

Specific areas for action were identified as follows:

- Promote the involvement of communities in the planning, management, and assessment of immunization activities, actively soliciting community views and responding appropriately to them.
- Seek effective means to involve women's groups in promoting immunization and other preventive health programs. Appropriate lesson plans, reading, and other informational materials should be developed for schools which help pupils become effective promoters of these preventive actions for their younger siblings and for others in the community. Special efforts should be made to educate girls, recognizing the benefits in their future role as mothers and recognizing that many of them currently have fewer educational opportunities than boys. The above efforts will require joint initiatives between ministries of health, education, communication and other ministries concerned with community development. Adequate financial support for such activities should be provided in program budgets.
- Efforts should be made to integrate information/ education materials dealing with immunization with those dealing with other important community health issues, particularly the control of diarrheal diseases and nutrition.
- An important aspect of community involvement in some areas is financial involvement. By supporting from local resources all or part of the costs of such items as fuel, salaries and buildings, communities may be able to realize the benefits

of immunization and other health services which would not be possible if national budgets alone were used. This means of accelerating the extension of health services should be actively investigated. Governments must, however, accept the major responsibility to provide services to those in need.

Source: WHO Wkly Epidem Rec 3:13-18.1983.

June 1983
Volume V, Number 3

Measles Vaccine Indicator Trial in Peru

The Peruvian Ministry of Health is collaborating with PAHO/WHO and the Program for Appropriate Technology in Health (PATH)[1] to field test a time-temperature indicator developed to monitor measles vaccine exposure to heat during its transport along the cold chain.

The indicator consists of a red paper disk which contains a chemical[2] with thermal characteristics similar to those of measles vaccine. The dot changes color from bright red, to dark red, and finally to black following accumulated exposures to high temperatures. After seven days at 37°C the indicator will turn black, a warning to the health worker that the vaccine has dropped below its minimum required potency and should not be used.

The indicator is designed to fit on the metal cap of a vial of vaccine. It has a pressure-sensitive adhesive back and is coated with a clear plastic material to protect health workers from the chemical and to minimize mechanical damage to the indicator. The color change is non-reversible.

PATH developed the indicator with the assistance of WHO/EPI, the London School of Hygiene and Tropical Medicine, OXFAM and the Edna McConnell Clark Foundation. The indicator's performance was verified in direct comparison to the heat degradation of measles vaccine made by various manufacturers. The results of laboratory tests demonstrate that the indicator's color change from red to black closely follows the degradation of measles vaccine. The indicator is calibrated to turn black when the vaccine titer is within 8% of the minimum potency recommended by WHO/EPI.

Field Trials

To test the indicator the Ministry of Health selected Region XVI (Loreto) where the ambient temperatures average +28°C and vaccine transportation along the cold chain is difficult. The particular strand of the cold chain chosen is shown in the accompanying map (Figure 1).

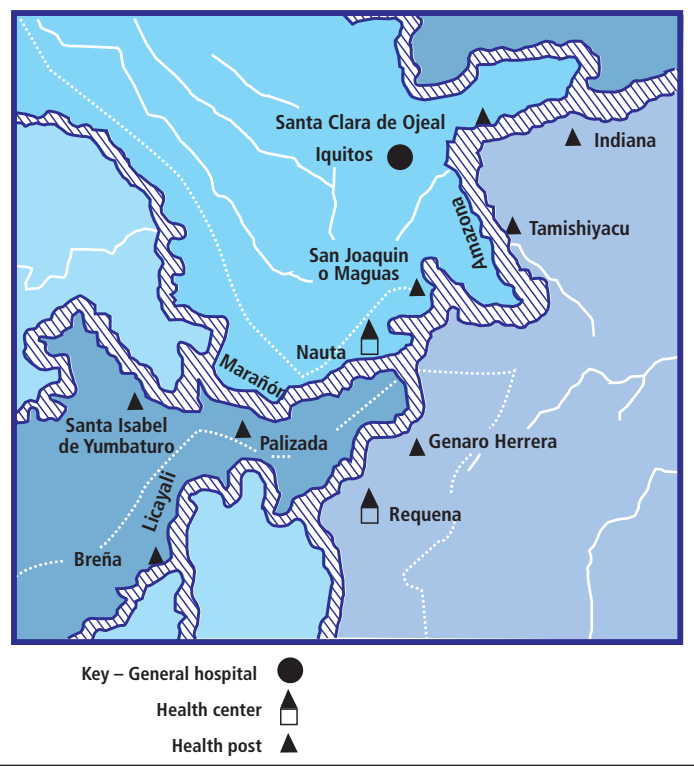
The EPI vaccines are airfreighted from Lima to Iquitos, where they are shipped by boat up the Amazon River to the health centers and posts. The time necessary to transport vaccine from Iquitos to Requena, for example, can vary from six to 14 hours depending on the kind of boat used.

A protocol for the study was prepared together with a chronogram of the activities required for its execution. The field trial was designed to meet the following objectives:

- to confirm the validity and reliability of the indicator;
- to confirm that color changes are correctly interpreted by health personnel;
- to evaluate the indicator's acceptability by heath personnel;
- to evaluate the indicator's mechanical performance.

The field test will last six months, ending around December 1983. During that time 1,100 indicators will be tested in the study area. Twenty-five vials with red indicators will be tested for titer levels during the study to confirm the sensitivity and specificity of the indicators. All vaccine vials with black indicators are automatically tested to verify if their titers have fallen below the minimum levels established by WHO as necessary to induce immunity.

FIGURE 1 Sites chosen for measles indicator field trials, Loreto, Peru, 1983.



Auxiliary nurse vaccinating children against measles in a small community located on the banks of the Amazon River, Peru.

Twenty-four health workers were trained to use the indicator. A set of instructions and accompanying forms on indicator use were developed for each level of the cold chain. Results of the post-test given to participants after their training yielded average scores of over 82%. The question most frequently missed showed that the students did not fully understand the time-temperature basis for the color change in the indicator.

At the end of the study the participants will be interviewed to determine their reactions to the indicator and its performance in the field.

Field trials of the indicator are also being conducted in the Philippines, People's Republic of China, Pakistan, Yemen Arab Republic, Egypt, Nepal, Kenya, Zimbabwe, and Argentina. The trials are supported by the Expanded Program on Immunization of PAHO and WHO, UNICEF, and the International Development Research Center (IDRC). A full report on the results should be available in early 1984.

References

1 PATH is a nonprofit, non-governmental organization devoted to the development and application of appropriate health technologies for primary health care programs in developing countries.

2 The chemical was developed by Allied Corp, USApor Allied Corp., U.S.A.

August 1983
Volume V, Number 4

International Symposium on Measles Immunization

The Proceedings of the 1982 International Symposium on Measles Immunization are now available in the Review of of Infectious Diseases, Vol. 5. No. 3 (May-June 1983). The Symposium was held at the headquarters of the Pan American Health Organization (PAHO) from 16 to 19 March 1982. Fogarty International Center of the U.S. National Institute of Health, in conjunction with PAHO/WHO and other institutions, organized the 4-day symposium which included participants from other countries.

The symposium had five major objectives: (1) to assess the impact of measles in countries with and without special vaccination; (2) to discuss the characteristics of currently available measles vaccine; (3) to assess the results of attempts at measles control and to discuss strategies needed to attain a high level of immunization in various parts of the world; (4) to evaluate the prospects of eventual eradication, and (5) to identify the need for further research on various aspects of the disease and its control.

The following summary from the Proceedings of the Symposium was written by Dr. Samuel L. Katz, Chief Rapporteur.

Summary of Current Status of Measles and Recommendations

The passage of 20 years since the first International Conference on Measles Immunization in November 1961 has been accompanied by significant advances in our understanding of the impact of measles among different groups, in the development and utilization of measles vaccines, and in control of the disease. Throughout all these considerations, there remains great variability, which is manifest in the surveillance data on morbidity and mortality, the extent of vaccine utilization, and the attitude about measles as a serious public health problem. Because of these variations it is obvious that any recommendations must be evaluated carefully and adapted appropriately to meet the needs of a given nation, a population group, a geographic locale, or an environmental setting.

Among the developed nations, there is a great divergence of attitudes and programs. The United States has reduced the reported number of measles cases by more than 99 percent in the past 15 years. Canada has also made striking headway in reduction of the impact of measles. Mexico reports significant progress on a national scale. Costa Rica has mounted an initially successful program. In much of Western Europe, there has been only modest change, and measles transmission continues. Eastern Europe (especially Czechoslovakia, Albania, Yugoslavia, and the USSR), like North America, has made great strides in the reduction of numbers of cases of measles, as has Japan. China's programs have been targeted initially at selected provinces with large populations, where programs of intensive immunization have resulted in 90 percent reduction in incidence.

Among the Central and South American nations, Costa Rica, Cuba, Chile, and parts of Brazil have achieved similarly effective progress: the most serious impact of measles appears essentially unchanged in much of Central America and tropical South America. Africa continues to devote increasingly greater attention to measles and to programs aimed at its control. The Gambia has demonstrated the possibility of termination of transmission but has also shown c1early the need for longitudinal continuation of programs for maintenance of successful control. Increasing data on morbidity, mortality, and sequelae lend further credence to the justification for eliminating measles as a hazard of childhood.

Vaccines in use throughout the world have proved safe and immunogenic. Stabilization has improved the viability of vaccines in field use, but the cold chain remains a necessity for optimal efficacy, even of the freeze-dried material. Laboratory assessment of vaccine stability has been standardized and offers specific dimensions for the tolerable duration and degree of exposure to heat light. Nearly all vaccines currently are prepared in chick embryo cell cultures, except for the Yugoslavian vaccine, which is prepared in human diploid cells; the Iranian AIK-C strain, prepared in MRC-5 human diploid cells; and the USSR Leningrad-16 vaccine, prepared in quail embryo cells.

Although all vaccines are currently administered primarily by syringe and needle, or by jet inoculation, the proposal for reexamination of aerosol administration was greeted with interest and enthusiasm and merits further study. Representatives of the pharmaceutical industry,

government, and national laboratories addressed the question of availability of production facilities sufficient to guarantee an adequate supply of vaccine.

It was apparent that motivational issues were at least as important as technologic ones. Especially in the developed nations, a more overt commitment to measles control is needed by many key individuals. In contrast, the developing nations face major management problems, often related to the structure of primary health care delivery systems. Once a program for measles immunization has begun, it is essential that a maintenance program be put in place for a sustained, continuing effort to reach new susceptibles. Clinical surveillance is more practical than laboratory testing for assessing program success in most such areas. When laboratory surveillance is used, it appears that the HAI test is the most convenient and reproducible, but attention must be devoted to better antigens and more responsive erythrocytes. The drop in HAI antibody titers after the initial demonstration of an increase following vaccination should not be equated with waning immunity. The group for whom further study is needed are those infants receiving vaccine before their first birthday. These studies should determine the completeness of their initial response, their subsequent antibody response to a second dose of vaccine after their first birthday, and, most important, their enduring resistance to clinical infection. On the other hand, there seems to be no convincing evidence at present of a need for booster doses in children immunized successfully after 1 year of age.

Although it may initially be advisable to immunize infants younger than 1 year of age-at 6 to 9 months-to reduce epidemic transmission and disease, eventual control by vaccination at or after the first birthday is a desirable goal. If the aerosol experiments should demonstrate the ability to overcome or bypass transplacental immunity, then this restriction could be removed, and immunization in very early infancy or even neonatal immunization could be considered.

For those vaccinated after the first birthday, second doses of vaccine should be regarded not as boosters but as "fill-ins" for that 5-10% of recipients who may have failed to respond to the initial exposure. Whether such "fill-ins" are given must be a decision based on the economics and logistics of a given program. In general it is more efficient to concentrate on extending initial vaccination to the greatest number of recipients rather than administering multiple doses to a more limited number. The need and desirability of a second dose should be carefully assessed and followed with proper clinical, serologic, and epidemiologic surveillance.

Contraindications to vaccine, other than the defined, rare cases of infants with immunodeficiency, have not been a major consideration. Pregnant women have been empirically excluded, but there is no evidence for untoward effects of vaccine virus in the embryo or fetus. Inclusion or exclusion of infants and children with intercurrent febrile illness is a good example of the flexible variability to be utilized. Vaccination of a child with intercurrent febrile illness might be postponed in a private pediatric office but not in a field setting.

Agreement is incomplete on the current and future management of individuals who previously received inactivated measles vaccines. Used mainly in the middle and late 1960s, these vaccines were distributed in only a limited number of nations to a relatively small number of recipients. Probably Canada and Japan have the largest reservoir of such recipients. Local decisions will produce the recommendations for these selected groups. All programs, of every type, must be preceded, accompanied by, and sustained with educational materials to motivate and to inform. Strategies for continued motivation are essential, since the initial anxieties that accompany a high incidence of disease can be expected to give way to complacency once disease patterns have been greatly reduced. An adequate, retrievable record system or some appropriate substitute is essential so that evidence of immunization can be documented and preserved, for the individual child and for the evaluation and surveillance of the program.

As various nations achieve measles control within their own boundaries, the problem of importations from countries where programs are less successful, or nonexistent, will become more apparent and increasingly troublesome. This problem will further emphasize the need for the favored, developed nations to provide assistance of many types to their brethren in the less-favored, developing nations. Unique strategies may be required to overcome disease patterns in certain areas.

Although an initial goal is to utilize immunization as a means of measles control, an eventual goal must be that of measles eradication. There is no known biologic reason why successful measles immunization cannot be extended to all the world's children. The challenge before us now is to exploit the available vaccines and to overcome the remaining economic, logistical, and attitudinal barriers. Each of us must return to his/her own constituents and continue to expand the efforts already in motion or to initiate those that are lacking. Measles can be eliminated as a universal cause of childhood misery and of long-term disabilities.

Source: Reviews of Infectious Diseases 5:3. 1983.

October 1983
Volume V, Number 5

Measles Vaccine Indicator Trial in Brazil

The Special Public Health Service Foundation (FSESP) of Brazil's Ministry of Health is field-testing a time-temperature indicator developed to monitor measles vaccine exposure to heat during its transport along the cold chain.

The field test is being carried out in collaboration with EPI/PAHO, PAHO's Program for Health Technology Development, and the Program for Appropriate Technology in Health (PATH).[1]

The indicator is a red paper disk designed to adhere to the metal cap of a vaccine vial. It contains a chemical (developed by Allied Corp., USA) with thermal characteristics similar to those of measles vaccine, and changes color in accordance with the ambient temperature. A clear plastic coating on the disk protects health workers from chemical and minimizes mechanical damage to the indicator. The color change is non-reversible.

The indicator turns darker following accumulated exposures to heat until, after seven days at +37°C (or the equivalent exposure), it turns black. This is a warning to the health worker, that the vaccine may have dropped below its minimum required potency and should not be used.

Field Trials

The field trial was designed to meet the following objectives:

- to confirm the validity and reliability of the indicator;
- to confirm that color changes are correctly interpreted by health personnel;
- to evaluate the indicator's acceptability by heath personnel;
- to evaluate the indicator's mechanical performance.

FSESP is conducting the field trials in the state of Goias, (Tocantinopolis county). The vaccines, which are produced nationally, are airfreighted from Rio de Janeiro to Goiana (state capital of Goias). where they are transported 1,300 km by car to the city of Tocantinopolis for distribution to health facilities.

The field tests will take six months to complete, ending around March 1984. Test results show that the 23 persons trained to use the indicator have a good understanding of how it works.

Approximately 2,000 indicators will be tested. Fifty vials whose indicators have remained red will be tested for titer levels during the study to confirm the sensitivity and specificity of the indicators. Control tests will be conducted by the Oswaldo Cruz Foundation in Rio de Janeiro and the London School of Hygiene and Tropcal Medicine. All vaccine vials with black indicators are automatically tested to verify if their titers have fallen below the minimum levels established by WHO.

Further field trials of the measles indicator are also being conducted in Peru (see EPI Newsletter Volume V, Number 3), the Philippines, People's Republic of China, Pakistan, Yemen Arab Republic, Egypt, Nepal, Kenya, Zimbabwe, and Argentina. The trials are supported by the Expanded Program on Immunization of PAHO and WHO, UNICEF, and the International Development Research Center (IDRC). A full report on test results should be available in 1984.

Reference

1 PATH is a nonprofit, non-governmental organization devoted to the development and application of appropriate health technologies for primary health care programs in developing countries.

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EPI Vaccines: Indications and Contraindications (I)

Introduction

Immunization is one of the most powerful and cost effective weapons of modern medicine. Immunization services, however, remain tragically under-utilized in the world today. In developing countries 1/2% of all newborns can be expected to die from neonatal tetanus, 2% from pertussis and 3% from measles. In all, some 5 million children die from these diseases each year: 10 children with each passing minute. These diseases are preventable with currently available vaccines if children can be immunized early enough in childhood.

The decision to withhold the benefits of immunization from an eligible child, whatever the reason, should not be taken lightly. Unfortunately, health workers in many countries are faced with longs lists of contraindications which, when followed scrupulously, result in many children remaining unimmunized. The problem resulting from deferring immunization is greatest where access to health services is limited and the morbidity and mortality from vaccine-preventable diseases are high. Immunization is frequently postponed if children are ill, malnourished, or about to be hospitalized. Yet they are the very children for whom immunization services are most needed. They are the ones most likely to die should they acquire a vaccine-preventable disease.

The purpose of this paper is to review the benefits and risks of routine immunization of children with BCG, DPT, measles, and poliomyelitis vaccines, and, particularly for ill and malnourished children, to suggest circumstances in which immunization may be in the child's best interest.

Adverse Reactions to Immunization

Despite the high safety of the vaccines used in the EPI, complications do occur. Although their rates are difficult to estimate precisely, it is known that they are far less frequent than the complications caused by the diseases themselves. Some conditions, particularly fever and neurological syndromes, also occur spontaneously among unimmunized children. Against this background of disease, it is sometimes difficult to determine if a recent immunization is casually or merely coincidentally related to a child's illness. Convulsions, for example, may follow DPT or measles immunization, but the background rate is high. At ages 3 to 15 months, the monthly incidence rate of convulsions ranges from 0.8 to 1.4 per 1000 children.

Measles Immunization

Severe reactions following measles immunization are rare (Table 1). In the United States, neurological disorders, including encephalitis and encephalopathy have been reported once for approximately every million vaccine doses administered. However, the reported incidence rate of encephalitis or encephalopathy following measles immunization is lower than the observed incidence rate of. encephalitis of unknown etiology, two per 1 million children per 28-day period. This suggests that some of the reported severe neurological disorders may not be caused by measles immunization but related only in time. In the United Kingdom, however, the National Childhood Encephalopathy Study found a statistically significant association between the onset of acute neurological illness and measles immunization given 7 to 14 days before onset of illness in cases compared with controls. The relative risk for this period was estimated to be 2.5 times the background rate.

TABLE 1. Estimated rates of serious adverse reactions following measles immunization compared to the complication of natural measles infection and background rate of illness.

Adverse reaction	Measles complication rates per 100,000 cases	Measles vaccine adverse reaction rates per 100,000 vaccines	Background rate of illness per 100,000 persons
Encephalitis/ encephalopathy	50 - 400 (0.05% - 0.4%)	0.1	0.1 - 0.3
Subacute schlerosing panencepahlitis	0.5 - 2.0	0.05 - 0.1	-
Pneumonia	3,800 - 7,300 (3.8% - 7.3%)	-	-
Convulsions	500 - 1.000 (0.5% - 1%)	0.02 - 190	30
Death	10 - 10.000 (0.01% - 10%)	0.02 - 0-3	-

TABLE 2. Measles immunization of ill children in three African states.

Country	Children		Type of illness	Adverse reaction	Effect of immunization
	No.	Age (months)			
South Africa	214	6 - 60	Consecutive patients admitted to hospital	Temperature ≥ 38.9°C -12% Koplik spot and rash -8%	Reduced nosocomial measles compared to control wards
Zimbabwe (Rhodesia)	98	6 - 32	Hospital patients with: Gastroenteritis - 40% Bronchopneumonia - 30% Malnutrition - 12% Other infections Other Resp. infections -6% Meningitis -3% Other -9%	Temperatura ≥38.9°C -13% Rash -4%	Reduced nosocomial measles compared to unimmunized control group
South Africa	654	7 - 36	Patients hospitalized with: Gastroenteritis -35% Cardiac, renal diseases -35% Bronchopneumonia -17% Kwashiorkor, marasmus -12%		Non nosocomial measles compared to 9 cases and 3 deaths noted in the previous year. Overall mortality fropped by 49%.

About 5 to 15% of measles vaccines develop a temperature of 39.4°C or higher, beginning on the sixth day and usually lasting one or two days. Transient rash may occur in about 5% of vaccines.

Measles immunization, by preventing natural measles, reduces the risk of developing subacute sclerosing panencephalitis (SSPE).

Immunization of Ill or Malnourished Children

Health personnel are understandably cautious in offering immunization to any child who is not healthy. But, as already discussed, such children may be particularly benefited by immunization. In most cases, it is safe and effective.

The most ample literature on this subject concerns measles immunization. Several studies have investigated measles immunization of malnourished or ill children. McMurray et al studied serum antibody responses and reaction rates to measles vaccine in normal and moderately malnourished 10-month-old Colombian children. The children were followed for more than a year. Malnourished children had high measles antibody responses and had no more adverse reactions than well-nourished children. The authors concluded that measles vaccine is both safe and effective in moderately malnourished children.

Ifekwunigwe et al studied serum antibody responses and adverse reactions following measles immunization of malnourished Nigerian children 5 months to 9 years old. Malnutrition did not impair the children's serological responses; of Ill children who were seronegative before immunization, 94% seronverted. There were no major adverse reactions to immunization during the 8-week follow-up period.

The authors concluded that malnutrition should be a prime indication for measles immunization rather than a contraindication because antibody responses are normal and because natural measles is often severe in malnourished children.

In most other studies nutritional status appeared to have no significant effect on measles seroconversion rates when measles vaccine was administered alone or simultaneously with DPT vaccine. In one investigation, however, children with severe kwashiorkor had impaired responses to measles immunization compared to well children.

The results of three studies of measles immunization of ill hospitalized children are shown in Table 2. The studies were conducted in hospital pediatric wards during efforts to control hospital-acquired measles, a cause of high morbidity and mortality. Children with a wide range of acute and chronic illnesses were included; reasons for exclusion were a terminal illness, a history of measles, steroid therapy or an immunologic disorder. The authors concluded that measles immunization of ill or malnourished children did not appear to adversely affect the course of the children's illnesses and that the risk of measles crossinfection in pediatric wards practicing measles immunization was diminished considerably.

In Ivory Coast a policy of immunizing sick children was introduced in 1981. All children between 9 and 35 months of age visiting health centers because of illness other than measles were screened; if unimmunized against measles, they were immunized. The introduction of the new policy resulted in a near doubling of the number of doses of measles vaccine administered, from 26,000 to 45,000 doses in comparable 6-month periods.

Limited data are available concerning the use of the other EPI vaccines in malnourished or ill children.

In two of these studies, however, only one or two doses of unadsorbed rather than adsorbed tetanus toxoid was given. In more recent studies malaria had no major effect on the serological response to adsorbed tetanus toxoid, measles or DPT vaccines.

Source: Immunization of children: Indications and contraindications for vaccines used in the Expanded Program on Immunization. WHO working paper EPI/GAG/82/WP.8/Rev. 3.

Editorial Note:
Due to its length, the preceding article has been divided into two parts and will be concluded in the next issue of the *EPI Newsletter*. The final section discusses national policies concerning contraindications to immunization and lists recommendations of the EPI regarding the immunization of ill or malnourished children, as well as general guidelines for health workers to use when considering the immunization of an individual child.

The sixty-six references reviewed for this paper have not been listed here, but will be made available to interested readers. Anyone wishing to obtain a complete copy of the original article, including all bibliographic references, should write to the *EPI Newsletter* editor, Pan American Health Organization, 525-23rd St., N.W., Washington, D.C. 20037 (USA).

1984

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The EPI Vaccines: Indications and Contraindications (II)

The first part of this article was published in *EPI Newsletter* Vol 6 (December 1983) and dealt with the specific adverse reactions associated with BCG, DPT, measles and polio immunization, as well as the immunization of ill or malnourished children.

National Policies Concerning Contraindications to Immunization: Agreements and Disagreements

Countries have adopted similar policies with respect to certain possible contraindications to immunization and different policies with respect to others. Policies are often based on theoretical concerns rather than acts; needed data frequently are lacking. There is general agreement that immunization should be deferred in the presence of a severe febrile illness. The reasons are to avoid the risk of superimposing possible adverse effects from the vaccine on the underlying febrile disease and to avoid a manifestation of the illness being attributed to the immunization.

There is also a consensus that vaccines requiring multiple doses such as DPT should not be repeated if a severe reaction occurred after a previous dose. Such reactions include collapse or shock-like state, persistent screaming episodes, temperature above 40°C, convulsions, severe alterations in consciousness or other neurological symptoms, anaphylactic reactions, thrombocytopenia or hemolytic anemia. In the case of DPT, subsequent immunization with diphtheria and tetanus toxoid is recommended. Local reactions at the site of injection or mild fever do not by themselves preclude the further use of DPT or other vaccines.

Also, live vaccines should not be administered to persons with immune deficiency diseases or to persons whose immune response may be suppressed because of leukemia, lymphoma, generalized malignancy or therapy with corticosteroids, alkylating agents, antimetabolic agents or radiation.

There is disagreement about other issues. For simplicity a few examples have been selected from two English-speaking countries, the United Kingdom and the United States, both of which have well-developed immunization services and both of which have clear national recommendations concerning the indications for immunization. In the United Kingdom, the Department of Health and Social Security includes untreated tuberculosis as a contraindication to measles immunization, and recommends that children with a history of convulsions, epilepsy, chronic heart or lung disease or who are seriously underdeveloped, be given measles vaccine only with the simultaneous administration of human immunoglobulin. The United States Public Health Service Advisory Committee on Immunization Practices (ACIP), on the other hand, finds no convincing evidence that measles immunization exacerbates tuberculosis and concludes that the benefit of measles immunization far outweighs the theoretical risk of exacerbation of tuberculosis. The ACIP recommends that measles vaccine should never be administered simultaneously with immunoglobulin and does not recognize any neurological contraindications to measles immunization.

Recommendations of the Expanded Program on Immunization

It does not seem feasible nor desirable to formulate a universal set of recommendations for immunization of children. Each country should formulate its own policies reflecting local appraisal of risks and benefits, operational feasibility, and socio-cultural acceptability of the specific recommendations. The national health authorities responsible for providing immunization services should play an active role in formulating the policies.

Whatever specific policies are adopted, health workers

should know that the benefits of routine childhood immunization are great and the risks of serious adverse reactions are very low. Absolute contraindications to immunization with the EPI vaccines are very few and, in general, children should not be denied immunization without good reason. Health workers should use every opportunity to immunize all eligible children, including ill or malnourished children. It is particularly important to immunize ill or malnourished children under the following circumstances:

- where there is a high incidence or an increased severity of the EPI target diseases, especially in children less than 18 months old;
- where access to health services is limited, where prompt follow-up is difficult and where immunizations are not likely to be completed if postponed;
- where immunization coverage is low;
- where children are most likely to visit the health services only when they are ill;
- where admission to hospital or attendance at health facilities is, in itself, an important factor in the spread of infectious diseases of childhood, particularly measles;
- where refusal to immunize is likely to result in the child not being brought back for further immunizations.

Health workers will inevitably be faced with using their own best judgment when considering the immunization of an individual child. Often they have little time for screening, and need some simple and clear guidelines. The following are proposed:

- Every child visiting a health facility should be screened to determine immunization status, and eligible children should be immunized.
- Children with malnutrition, low grade or moderate fever, respiratory infection, diarrhea or other minor illnesses should be immunized. Immunization of children, so ill as to require hospitalization should be deferred for decision by the hospital authorities.
- Hospitalized children should be immunized before discharge and in some cases upon admission—for example where there is a risk of hospital-acquired measles.
- A DPT series should be completed unless a child suffered a severe adverse reaction to previous dose. If so diphtheria and tetanus (Td or DT) vaccine without pertussis antigen should be given instead.
- Children with diarrhea should be offered oral polio vaccine. However, this dose should not be counted as part of the full series and the child should be given another dose at the first available opportunity.

Source: Immunization of children: Indication and contraindication for vaccines used in the Expanded Program on Immunization. WHO working paper EPI/GAG/82/WP.8/Rev. 3 (complete copy including all bibliographic references available on request to the editor).

June 1984
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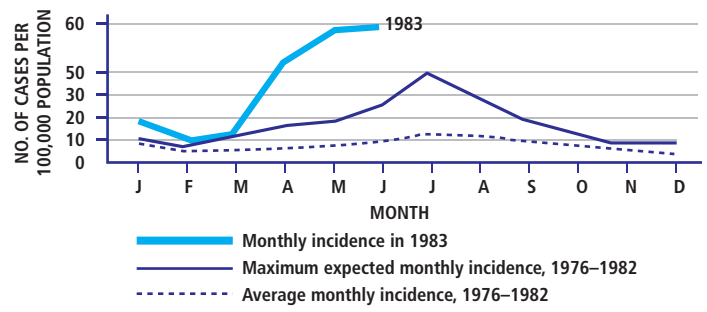
Investigation of a Measles Outbreak in Planaltina, Federal District, Brazil

In April 1983 the Federal District of Brasilia. Brazil, registered an unusual increase in the number of reported measles cases (Figure 1). Preliminary analysis of the cases showed they were evenly distributed in all eight administrative regions of the Federal District, an area occupying 5,771 km² in the central Brazilian plateau, with a tota1 population of nearly 1.2 million inhabitants almost entirely urban (96%).

Vaccination data for the previous few years indicated that coverage in children under 1 year of age was around 70 percent. In view of the outbreak, Federal District health authorities decided to intensify measles vaccination in the first half of May, targeting the age group of children 9 months to 9 years of age, who accounted for over 70% of all reported cases. Over 60,000 doses of vaccine were administered in this period as to only 5,000 doses which would normally have been given by mid-June. However, the incidence of the disease was even higher than before.

FIGURE 1 Monthly measles incidence in Federal District of Brazil, January–June 1983. Maximum expected monthly incidence and average monthly incidence, 1976-1982.



Sample Survey Methodology

The persistence of the measles epidemic despite apparently high levels of vaccination coverage led the ministry of Health to initiate an epidemiologic investigation of the situation. Authorities chose Planaltina, one of the Federal District's eight administrative regions (Figure 2), as the site of a random sample survey to determine vaccination coverage and vaccination history by age group, vaccine efficacy, and history of the disease during the outbreak. Planaltina's population (60,000 inhabitant in 1983) and demographic distribution (85 percent urban) offered ideal conditions for this type of study.

For the purpose of the study, Planaltina was divided into 244 blocks (clusters) with an average of 37 households per block. Thirty c1uslers were selected for the survey.[1]

FIGURE 2 Administrative regions of the Federal District (F.D.) of Brazil.

Health agents used a standard questionnaire to collect information on the outbreak and search for additional cases that might have occurred during the previous six months.[2] Questionnaires were completed in 997 households (11 percent of all households) over a period of two weeks, beginning 25 June 1983.

Results

As the increase in measles incidence had begun several months before the survey, it was decided that the study would cover the first six months of 1983. The survey measured vaccination coverage on 31 December 1982, considered the beginning of the epidemic, and 30 June 1983. As shown in Table 1, coverage in children under 10 years of age had increased to 84% by the end of June. Coverage rates for each of the years between 1978 and 1981 (Table 2) were at least 60 percent, and had reached nearly 70 percent by the end of 1982 (Table 1).

A total of 300 cases occurring between January and June 1983 were recorded during the investigation. One hundred six cases (40%) of those with known vaccination histories occurred in vaccinated individuals while 158 (60%) occurred in unvaccinated individuals. Children under 5 years of age accounted for 212 (70%) of cases. (Table 3).

Vaccine efficacy was calculated both for children who received vaccination before 9 months of age and for those who were vaccinated at 9 months or later, since prior to February 1982 the national immunization schedule had called for measles vaccination starting at 7 months of age.[3] The following formula was used in the calculation:

$$VE = \frac{\text{AR in unvaccinated} - \text{AR in vaccinated}}{\text{AR in unvaccinated}} \times 100$$

where VE = vaccine efficacy and AR = arrack rate.

The data showed that vaccine efficacy was only 43 percent for children who received the vaccine before 9 months of age while it was 83% for children who were vaccinated later. Of the 300 measles cases investigated, 61 (20%) occurred in children less than 1 year of age. Of the 61 cases, 39 (64%) occurred in children less than 9 months of age while 57 (93%) were in unvaccinated children.

Although the total vaccination coverage of children 9 months to 9 years of age went from 68.4 to 84% between 31 December 1982 and 30 June 1983, the survey showed that coverage of children who had not previously had measles only increased from 50 to 55%. This explains why the increased measles vaccination was not effective in stopping the outbreak.

The source and site of transmission were identified for 30 of the 61 cases occurring in under l-year-olds (Tables 4 and 5). In all but two cases the sources of infection were children older than 1 year, and transmission usually occurred either in the individual's own or a neighboring household (60%), or in a hospital or polyclinic (20%).

Control Measures

The intensification of measles vaccination that began in May 1983 was not effective in controlling the outbreak, despite the large number of doses applied and the high coverages which already existed. The number of children successfully immunized against measles was considerably lower than that indicated by the December 1982 vaccination coverage since the majority of children had received their vaccinations before reaching 9 months of age, when vaccine efficacy was quite low. Neither did the mass vaccination in May represent a significant increase in either vaccination coverage or immunity, since many of the children covered had already been vaccinated or had had measles.

As an immediate measure, the Ministry of Health recommended that measles vaccine be administered simultaneously with polio vaccine during the national polio immunization day on 13

TABLE 1. Measles vaccination coverage, by age group, in Planaltina (F.D.), Brazil, 31 December 1982 and 30 June 1983.

Age group	31 December 1982	30 June 1983
9 –11 months	38.2	71.9
1–4 months	77.6	88.1
5–9 years	59.7	80.1
TOTAL: 9 months–9 years	68.4	84.0

TABLE 2. Estimated measles vaccination coverage rates in children less than 1 year of age, Planaltina (F.D.), Brazil, 1978–1981.

Year	Coverage (%)
1978	62.8
1979	63.6
1980	75.6
1981	66.5

106 (40%) occurred in vaccinated persons and 158 (60%) in unvaccinated persons. In children less than five years old, 212 cases occurred.

TABLE 3. Number of measles cases, by age group and vaccination history. Planaltina (F.D.), Brazil, January–June 1983.

Age group (in years)	Vaccinated		Not vaccinated	Unknown	Total
	< 9 months	≥ 9 months			
< 1	–	4	57	–	61
1–4	56	21	51	23	151
5–9	19	6	29	11	65
10–14	–	–	15	–	15
≥15	–	–	6	2	8
TOTAL	75	31	158	36	300

TABLE 4. Age of source of infection for 30 measles cases in children less than 1 year of age, Planaltina (F.D), Brazil, January–June 1983.

Age of the infection source	Number	Percent
9 months[a]	1	3.3
9–11 months[b]	1	3.3
1–4 years	18	60.0
5–9 years	4	13.3
≥ 10 years	6	20.0
TOTAL	30	99.9

(a) Resident of same household.
(b) Resident of neighboring household.

TABLE 5. Site of transmission for 30 measles cases in children less than 1 year of age., Planaltina (F.D.), Brazil, January–June 1983.

Site of transmission	Number	Percent
Neighboring household	14	36.8
Same household	12	31.6
Hospital or clinic	8	21.1
Visitor	3	7.9
Day care center	1	2.6
TOTAL	38	100.0

August 1983. This plan was put into effect for the whole Federal District and a total of 62,756 children 9 months to 4 years of age (2,416 in Planaltina) were vaccinated at that time.

Source: Boletim Epidemiológico XV(16):129-137, 1983.

1. See "Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling method." RH Henderson and T Sundaresan, Bulletin of the World Health Organization 60(2):253-260, 1982. Also Programa ampliada de imunização PAI. Curso sobre planificação, administração e avaliação. Pan American Health Organization and Ministry of Health of Brazil, Brasília, 1980.
2. Questionnaires were adapted from models developed by consultant Alan Hinman in his report Measles mortality and morbidity in Brazil, December 1981.
3. In 1973 the Ministry of Health had lowered the recommended age for measles vaccination to 8 months and subsequently to 7 months in an attempt to control the incidence of measles cases in children under 9 months of age. The strategy did not have the desired effect however in February 1982 the recommended age for vaccination was raised to 9 months.

Editorial Note:
In February 1982, the Ministry of Health raised the recommended age for measles vaccination from 7 to 9 months. The results of the present investigation support this decision, in view of the low vaccine efficacy (43%) when administered prior to 9 months and the low transmission among children under 1 year of age. The findings also substantiate the conclusions of the collaborative Latin American study on the optimum age for measles vaccination in which Brazil took part.* Finally, the survey confirms the importance of identifying those population groups which are not being vaccinated. These groups are not only at highest risk of getting the disease, but also remain foci for transmission.

* Seroconversion rates and measles antibody titers induced by measles vaccine in Latin American children 6-12 months of age. Collaborative study by the Ministries of Health of Brazil. Chile, Costa Rica, Ecuador, and the Pan American Health Organization. Bulletin of the Pan American Health Organization 16(3): 272-285. 1982.

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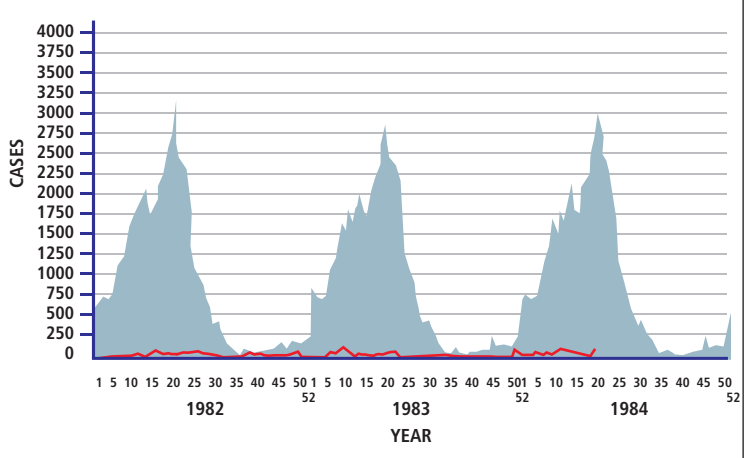
Measles in the United States, First 26 Weeks, 1984

During the first 26 weeks of 1984, a provisional total of 1,759 measles cases was reported in the United States (incidence rate 0.8 per 100,000 population) (Figure 1). This represents a 60.6% increase from the 1,095 cases reported during the same period in 1983 (0.5/100,000). A total of 1,234 cases (70.2%) was reported from four states —Michigan (430), Texas (377), California (267), and Illinois (160). Nine states (New Mexico, Michigan, Hawaii, New Hampshire, Texas, Washington, Utah. Illinois, California) and New York City had incidence rates of 1/100,000 population or higher.

Although the overall incidence rate increased, the number of states reporting measles decreased during the first 26 weeks of 1984, compared with the same period of 1983. Twenty-four states reported no measles cases (indigenous or imported), compared with 22 states and the District of Columbia during the same period in 1983. In 1984, 80 (2.5%) of the nation's 3,139 counties reported measles cases during the first 26 weeks, compared with 95 (3.0%) during the same period in 1983 (Table 1).

FIGURE 1 Reported measles cases*, United States, 1982–1984.



*Solid line represents reported cases, shaded area represenls maximum and minimum weekly values during 5-year period, 1977–1981.

One hundred seventy-five cases (9.9%) were associated with international or out-of-state importations-an average of 6.7 cases per week-compared with 174 cases during the same period in 1983.[1]

During the first 26 weeks, detailed information was provided to the Division of Immunization, CDC, on 1,765 cases. The difference between this number and the 1,759 cases reported to the MMWR reflect delays in reporting. Of 1,765 cases, 1,723 (97.6%) met the standard clinical case definition for measles[§] and 721 (40.8%) were serologically confirmed.

Among most of the measles patients, onset of rash occurred from week 9 through week 15, peaking at week 11 (130 cases) (Figure 2).

Age characteristics of reported cases changed from 1983 to 1984 (Table 2). In 1983, the highest incidence rates were reported for preschoolers. In contrast, the rates for the first 26 weeks of 1984 were greatest for children 10 years to 14 years of age who experienced a more than twofold increase in incidence rates, compared with all of 1983. Of the 351 preschoolers who had measles in 1984, 92 (26.2%) were under 12 months of age; 68 (19.4%) were 12-14 months of age; 18 (5.1%) were 15 months; and 173 (49.3%) were 16 months to 4 years of age. Persons 12-14 months of age accounted for 3.9% of the 1,765 cases.

Of the 1,765 persons with measles, 911 (51.6%) had been vaccinated; 776 (44.0%) had been vaccinated on or after the first birthday; and 135 (7.6%) had been vaccinated before the first birthday (Table 3). A total of 854 (48.4%) persons were either unvaccinated or of unknown vaccination status. Prior physician-diagnosed measles in the absence of vaccination was reported for 21 (1.2%) persons.

Of the 1,765 cases, 610 (34.6%) were classified as preventable*[1] (Table 4). The highest proportion of preventable cases occurred among persons who were not of school age. More than 70% of the cases among children 16 months to 4 years and adults 20-24 years were preventable. Although more than half of the preventable cases occurred among persons 5-19 years of age, only 29.5% of cases occurring in that age group were considered preventable. The proportion of preventable cases in this age group increased progressively with increasing age.

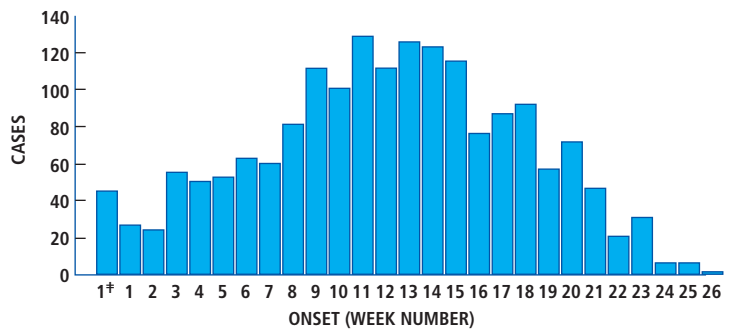
Of the 1,155 persons who had nonpreventable measles, 178 (15.4%) were too young for routine vaccination (15 months

TABLE 1. Geographic distribution and incidence rates* of measles cases, United States, first 26 weeks, 1983 and 1984.

	1983	1984
No. cases	1,095	1,759
Incidence rate‡	0.5	0.8
States without measles	22	24
Countries without measles	3,044 (97.0%)	3,059 (97.5%)

* Provisional data.
‡ Per 100,000 population.

FIGURE 2 Reported measles cases, by week of rash onset*, United States, first 26 weeks, 1984.



* No dates of rash onset reported for seven patients.
‡ Rash onset in 1983.

TABLE 2. Age distribution and estimated incidence rates* of measles cases. United States. 1983 and first 26 weeks of 1984.**

Age group	1983 (52 weeks)[a]			1984 (26 weeks)[b]		
	No.	%	Rate	No.	%	Rate
0–4 years	451	31.5	2.6	351	19.9	2.0
5–9 years	160	11.2	1.0	201	11.4	1.3
10–14 years	195	13.6	1.1	515	29.2	2.9
15–19 years	382	26.7	2.1	470	26.6	2.4
20–24 years	163	11.4	0.8	137	7.8	6.6
≥25 years	80	5.6	0.1	91	5.1	0.1
Known	1,431	95.6	–	1,765	100.0	–
Unknown	66	4.4	–	–	–	–
Total	1,497	100.0	0.6	1,765	100.0	0.8

* Cases per 100,000 population extrapolating cases with known age to total reported cases.
** Provisional data.
a Total cases reported to the MMWR in 1983.
b Total cases reported to CDC's Division of Immunization during the first 26 weeks of 1984.

TABLE 3. Age at most recent measles vaccination, United States, first 26 weeks, 1984.*

Age at vaccination	Measles cases	
	No.	%
<12 months	135	7.6
12–14 months	255	14.4
15 months	34	1.9
16 months–4 years	303	17.2
5–9 years	139	7.9
10–14 years	32	1.8
15–19 years	8	0.5
≥20 years	2	0.1
>12 months‡	3	0.2
Unvaccinated or unknown	854	48.4
Total	1,765	100.0

* Provisional data.
‡ Unknown age at vaccination, definitely older than 12 months.

TABLE 4. Age distribution and preventability of measles cases, United States, first 26 weeks, 1984.*

Age group	No. cases	No. preventable (%)	No. non-preventable (%)
<15 months	178	0(0%)	178 (100%)
16 months–4 years	173	127 (73.4%)	46 (26.6%)
5–9 years	201	43 (21.4%)	158 (78.6%)
10–14 years	515	137 (26.6%)	378 (73.4%)
15–19 years	470	170 (36.2%)	300 (63.8%)
20–24 years	137	106 (77.4%)	31 (22.6%)
25–29 years	51	27 (52.9%)	24 (47.0%)
≥ 30 years	40	0 (0%)	40 (100.0%)
Total	1,765	610 (34.6%)	1,155 (65.4%)

* Provisional data.

TABLE 5. Reasons measles cases were classified as non-preventable, United States, first 26 weeks, 1984.*

Causes of nonpreventability		No. cases (%)	Total cases (%)‡
1. Persons <16 months of age (too young for routine vaccination)		178 (15.4%)	(10.1%)
2. Born before 1957 (vaccination is not routinely recommended)		57 (4.9%)	(3.2%)
3. Persons 16 months – 27 years		920 (79.7%)	(52.1%)
a. Adequately vaccinated (on or after the first birthay)	775 (84.2%)[a]		
b. Prior physician diagnosis	18 (2.0%)		
c. International importations (non-U.S. citizens)	32 (3.5%)		
d. Exemptions	41 (4.5%)		
1. Medical	4 (10%)		
2. Religious	16 (39%)		
3. Philosophic	16 (39%)		
4. Non-specified	5 (12%)		
e. Laboratory evidence of immunity	54 (5.9%)		
Total		1,155 (100.0%)	(65.4%)

* Provisional data.
‡ 1,765 cases.
a Does not include adequately vaccinated patients born before 1975.

Editorial Note:

Although the number of reported measles cases has increased in 1984, compared with the same period in 1983, it is still far below the number in the prevaccine era (1950-1962), when an average of over 525,000 cases was reported annually. Despite the increased occurrence of measles during the first 26 weeks of 1984 over all of 1983, the geographic distribution of measles is more restricted and focal.

A total of 43.9% of the persons who had measles in 1984 had been adequately vaccinated. This is within expected limits, given the high vaccine coverage in the United States.[2] Since 1980, over 95% of kindergarten and first-grade students have had evidence of measles immunity. Higher coverage will be associated with higher proportions of persons who are vaccinated. Recent epidemiologic evaluations have shown a measles vaccine efficacy of 90% or higher. The increased occurrence of measles in 1984 does not appear to be due to poor vaccine efficacy.

Greater emphasis needs to be placed on ensuring that persons 10-14 years old and 15-19 years old have evidence of measles immunity.[3] Enactment and vigorous enforcement of regulations requiring all students in grades kindergarten through 12 to have evidence of immunity is an important means of ensuring high levels of measles immunity.[2]

Further efforts need to be made in preschool-and post-school- aged groups. Over 70% of the cases among young adults (20-24 years old) and preschoolers (16 months to 4 years old) were preventable. Every opportunity should be taken to vaccinate susceptible children against measles. Many colleges are considering regulations requiring evidence of measles immunity for matriculation.[4] All institutions where young adults congregate should consider requiring evidence of measles immunity.

of age or under). Fifty-seven (4.9%) were born before 1957; vaccination is not ordinarily recommended for this group. Of the 920 persons 16 months to 27 years of age who acquired measles, 775 (84.2%) had been vaccinated on or after the first birthday; 18 (2.0%) had prior physician-diagnosed measles; 32 (3.5%) had international importations and were not U.S. citizens; and 41 (4.5%) had exemptions under state law. In addition, 54 (5.9%) persons —recruits at Great Lakes Naval Training Station—were considered immune because they had positive results to an indirect immunoperoxidase assay for measles antibody before their illnesses (Table 5).

* A case is considered preventable if measles occurs in a U.S. citizen: (1) at least 16 months of age, (2) born after 1956, (3) lacking adequate evidence of immunity to measles (documented receipt of live measles vaccine on or after the first birthday and at least 2 weeks before onset of illness, or a physician-diagnosed measles or laboratory evidence of immunity), (4) without a medical contraindication to receiving vaccine, and (5) with no religious or philosophic exemption under state law.

Reported by N El-Tantawy, MD, Emory University School of Medicine, Atlanta, Georgia; Div. of Immunization, Center for Prevention Svcs, CDC.

Source: MMWR 33(35):495-504, September 7, 1984.

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1. CDC. Classification of measles cases and categorization of measles elimination programs. MMWRI982; 31:707-II.
2. CDC. Measles Surveillance Report No. II, 1977-1981. September 1982.
3. ACIP. Measles prevention. MMWR 1982;31:217-24, 229-31.
4. American College Health Association. Statement of immunization policy. November 25, 1983;1-3.

§ Fever (38.3°C [101°F] or higher, if measured), generalized rash of 3 days or longer duration, and at least one of the following: cough, coryza, conjunctivitis.

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Banishing Measles from the World

Can we eradicate measles? Should we eradicate measles? Will we eradicate measles?

The answer to the first question rests on scientific fact. We can eradicate measles. The smallpox eradication program proved that the worldwide eradication of certain infectious diseases is possible. Although there are obvious differences between measles and smallpox, there are also epidemiological similarities. They are both viruses that cause recognizable rashes, a characteristic that is helpful for epidemiological surveillance programs. They both confer lifelong immunity. Neither has an animal reservoir or is harbored in inapparent chronic earners among human beings.

Since 1963, an effective and safe vaccine for measles has been available, and it has been widely used in the US and other countries. In the past it has not been put to maximum use because a smoothly functioning cold chain of storage, transportation, and delivery was required to preserve the viability of the vaccine virus. There is now a more heat-stable vaccine that can remain potent in the freeze-dried state for 3-4 weeks at ambient tropical temperatures without refrigeration. The containers that maintain low temperatures and protect the vaccine have also been improved. Coupled with this technical progress is an economic advantage—the cost of measles vaccine has declined to only 10 cents per dose.

Measles can be controlled through the widespread and logical use of this vaccine.

The scientific evidence that measles can be eliminated seems to be solid. The second question to be asked is, "Should we eradicate measles?" In an era of scarce global resources, should money and talent be spent on eradication?

Again, the answer is yes, we should eradicate measles for reasons related to both health and economics. Measles is a major source of unnecessary suffering, premature mortality, and expense. Except in isolated populations, measles is nearly universal, most persons being infected before reaching the age of 15. Measles, under any circumstances, can cause serious complications. Among these are diarrhea, encephalitis, otitis media, pneumonia, and exacerbation of protein energy malnutrition. Therapy for measles and its complications is a major drain on medical care resources in most parts of Africa, Asia, and Latin America.[1]

It has been estimated that approximately 900 000 deaths from measles occur each year in the developing world.[1] In the Inter-American Investigation of Mortality in Childhood it, was found, that measles is the leading cause of death or the second leading cause in children aged 1-4 years in several cities in Latin America.[2] Measles outbreaks in Africa and Asia have case-fatality rates of 5-20% among children, especially malnourished ones.

Measles complications may also result in developmental

The death of a child is an everyday occurrence in many parts of the world; however, the mortality rate of children would be lowered if all children had access to the routine vaccination that are already commonplace in the developed world. (Photo: P. Almasy WHO)

retardation, lifelong handicap, and both direct, and indirect economic loss. Furthermore, in children in the developing world, measles interacts with diarrheal disease and malnutrition to increase the morbidity and mortality from these conditions. In the developed nations, where the disease is less severe and there are facilities for saving lives, it is still important to eliminate measles.

When the indigenous transmission of measles has ceased, the US must continue to bear the costs of routine vaccination, surveillance, and response to imported cases until global eradication is achieved. It has been estimated that these cost for both treatment and prevention, may exceed $50 million a year. The earlier, the global target of eradication is achieved, the sooner the USA can discontinue these expenditures. The nation bore the considerable cost of keeping its population free of smallpox for more than 25 years before the global smallpox eradication program began. The $32 million invested in the smallpox eradication program over 12 years is now saved every 3 months in the US because global progress against the disease made it possible to discontinue routine vaccination and other protective activities. The prevention of measles by vaccination was estimated to have yielded an annual net saving of $130 million for the period 1963-1972 in the US. The current annual saving is estimated to be approximately $500 million. Meas1es vaccination in the US is estimated to have a benefit-cost ratio of 10:1. The return of such an investment in the developing world, where morbidity and mortality for measles are higher, would be even greater. A preliminary analysis of vaccine programs in the lvory Coast suggests the benefit to cost ratio may well exceed 20:1.

The final question to be asked about the worldwide eradication of measles is the most difficult —will we do it? Can we muster the social will to eliminate another disease from the world? A realistic answer is that, probably, this will not be done for a long time.

While views on measles as a problem differ, its eradication is a worthwhile goal. A mechanism for achieving this goal is already being developed: the global Expanded Program on Immunization, coordinated by the World Health Organization. This program is successfully working with national governments and international donor agencies to ensure that immunization against five diseases will be routinely available to all the world's children by 1990.

The establishment of eradication as a goal might also help to simulate further action in many developed countries whose populations have immunization levels high enough to reduce measles incidence to a point where the disease persists but is no longer a conspicuous problem.

A realistic answer to the question, "Will we eradicate measles?" must also consider serious differences between smallpox and measles. Measles is a highly contagious disease, capable of causing explosive outbreaks and spreading rapidly. This characteristic contrasts with the epidemiology of smallpox, which generally spreads more slowly and could be contained by aggressive control measures. This difference between the two diseases suggests that an essential ingredient of any measles eradication program would be to attain and maintain extremely high immunization levels, probably in excess of 90%. Smallpox was eradicated by the containment of outbreaks and cases in many areas, but the

immunity rates of the general population were often less than 50%. Measles immunization will have to reach children in virtually all parts of a country simultaneously and successfully.

Another important difference between smallpox and measles concerns the age of infection. Smallpox frequently involves children of all ages and adults. In the developing world, the usual age for contracting measles is about 12-18 months. Measles vaccine cannot be given effectively before the sixth or ninth month of life, and maximum serum conversion may not occur in some populations until the children concerned are 12-15 months old. From this it would appear that a permanent primary care infrastructure capable of delivering vaccines routinely to the majority of the population is necessary for the elimination of measles transmission.

A final major difference is the greater difficulty of surveillance operations for measles compared with those of smallpox. Measles is more readily confused with other illnesses causing rashes, and it does not leave a visible, easily recognized trace such as the scars that helped to determine who was immune to smallpox. Occasional serological surveys will be required unless reliable records are available, and this will mean additional logistic and laboratory expenses.

Worldwide measles eradication is worth a special effort. The international public health community should strive for it, but the leaders should not hold out false promises of rapid accomplishment. Its achievement will be another major test of will, and failure will be measured by each case of measles that occurs. No measles case is inevitable. Each one is a failure of the public health establishment to convince society that eradication is a feasible goal deserving support.

Source: Dr. William H. Foege, World Health Forum, An International Journal of Health Development 5(1):63-65, 1984.

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2. Puffer. R.R. y Serrano. c.v. Pattems of mortality in childhood. Report of the Inter-Américan investigation of mortality in childhood. Washington, D.C. Organización Panamericana de la Salud, 1973 (Publicación Científica No. 262).

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National Vaccination Days in Bolivia: Higher Coverage Attained Through Public Participation

Since the inception of the Expanded Program on Immunization (EPI) in 1979, a better understanding of the vaccine-preventable diseases in Bolivian children has been achieved by provision of useful epidemiological data on the target EPI diseases. A strength of the EPI lies in that it is not confined to the use of a single delivery tactic or to a repetitive description of coverage gains, but focuses attention on sociocultural, economic, and political conditions, with a view to the application of new and more realistic tactics for the benefit of vulnerable and neglected population groups.

In 1980 and 1981, the coverage achieved by purely fixed health facility delivery tactics did not exceed 25% to 30% with the third dose of DPT and polio vaccines, or 28% with the single-dose vaccines (BCG and measles) among children under 3 years of age.

In 1982 a technical and administrative EPI evaluation was performed and impediments limiting the attainment of epidemiologically significant vaccination coverage were identified. The leading causes were found to be a lack of political commitment, a lack of participation by the public, poor coordination of the program with the general health services, rigid and uniform administrative standards for the whole country, the abstractness of the technical standards, and poor public information.

From this analysis emerged the strategy of mobilization of the population through the local health committees in order to help improve vaccination coverage. These local committees have been able to substantially improve the coverage of polio vaccination by aiding health staff in the application of oral vaccine during the operations carried out on National Vaccination Days, organized three times a year.

The implementation of this strategy in Bolivia since 1983 allows each user of health services to be an active agent for his/her health rather than a passive recipient of services. By participating in programs he/she exercises the right to health accorded him/her in the country's Constitution. An increasing number of Bolivians are becoming parties to health decisions that affect them as a result of the government's request and encouragement for popular participation. The achievements of mass mobilization for vaccination may be classified as follows:

It is important that parents participate actively in immunization activities and make sure their children complete the recommended series of vaccinations before they reach their first birthday. (Photo: P. Almasy/WHO)

Overall Achievements

- It has made the country's health condition an object of thought and discussion and helped the country to achieve the highest vaccination coverage in the last few years.
- It has prompted a revision of vaccination standards for the public.
- It has prompted responses to requests for health services from the public.
- It has given the health services a new image through the activities they have promoted.
- It has introduced a joint effort to identify the organizations, movements, and individuals that respond to interests of the public and genuinely seek to serve them.
- It has helped consolidate grass-roots organizations.

Specific Achievements

- It has provided the people with needed health information so that they become their own agents for health improvement.
- It has raised the level of institutional participation through analysis and self-criticism.
- It has effectively protected the infant population against polio and measles.

Some Preliminary Results: Measles

On the basis of reported cases, measles ranks sixth among the communicable diseases in Bolivia. This disease maintains its presence during July and its prevalence peaks in September, after which it begins declining in November. The age group most severely affected is that of children between 2 and 4 years of age. It ranks third among the causes of general morbidity in children under 5 years of age.

The years of highest incidence were 1972 and 1977, with 8,315 and 8,194 cases, respectively.

FIGURE 1 Measles trend in Bolivia, 1970–1983.

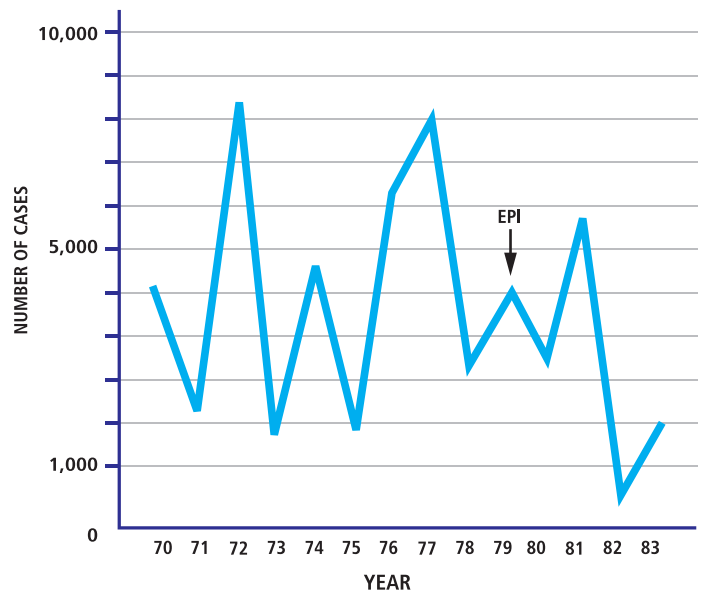

FIGURE 2 Measles vaccination annual coverage in children 1 year old, Bolivia, 1979–1984.

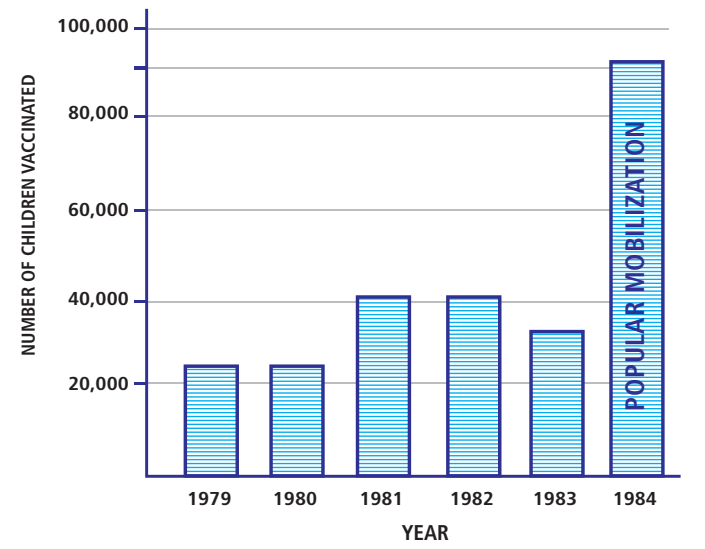

Figure 1 demonstrates that the number of cases dropped significantly in 1981. Vaccination against measles has been administered in Bolivia since 1965; however, the low coverage obtained was due to the program's limited coverage. In 1979 measles vaccination activities were made routine, but even so, coverage proved inadequate until 1984 when this vaccine was also included in National Vaccination Days.

A comparison of coverage among 1-year-olds vaccinated against measles from 1979 to 1983 reveals a considerably irregular pattern and even a significant drop in 1983. Due to the mass mobilization in 1984, the coverage of measles vaccination among 1-year-olds was 80% greater than it had been in 1983 and was the highest ever achieved in the country for this vaccine (see Figure 2).

Editorial Note:
This activity in Bolivia is an excellent example of the utilization of intensified strategies as mentioned in the Global Advisory Group report of 1984 which states the following:

"Intensified strategies have been developed in several countries in an effort to raise immunization levels more rapidly than would routine program implementation. These strategies include:

- Accelerated implementation of existing plans;
- Use of periodic rounds of intensified activity ("pulses" or "rounds");
- Designation of one or more days each year as national immunization days; on these days, all children in the target age group are immunized without regard to their previous immunization status; frequently only one vaccine is used (usually oral polio vaccine) and no attempt is made to complete the child's record;
- Designation of one or more days each year as national immunization days; all vaccines are available and used according to the child's needs; each dose given is entered on the child's record."

Bolivia's activities also represent a practical example of program acceleration and implementation called for in the first part of the five-point action program (Resolution WHA 35.31) of the Thirty-fifth World Health Assembly in May 1982:

"Promote EPI within the context of primary health care:

- Develop mechanisms to enable the community to participate as an active partner in program planning, implementation, and evaluation, providing the technical and logistical resources to support these functions; and
- Deliver immunization services with other health services, particularly those directed towards mothers and children, so that they are mutually supportive."

Their experience shows that measles can be controlled in Panama.

Source: Adapted from *Boletín epidemiológico.* CSS Panama. 8(10):1.1984.

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Measles in the Americas, 1980–1984

Measles continues to be the most frequently reported of the EPI preventable diseases. As shown in Figure 1, despite immunization coverage rates of over 60%, there was a resurgence of measles activity in the Region in 1984. The United States also reported an increase in overall incidence in 1984, although more states within the U.S. remained free of transmission in 1984 than during any previous year. Both the United States and Canada are engaged in measles elimination programs, and immunization coverage levels of over 95% have been attained in these areas.

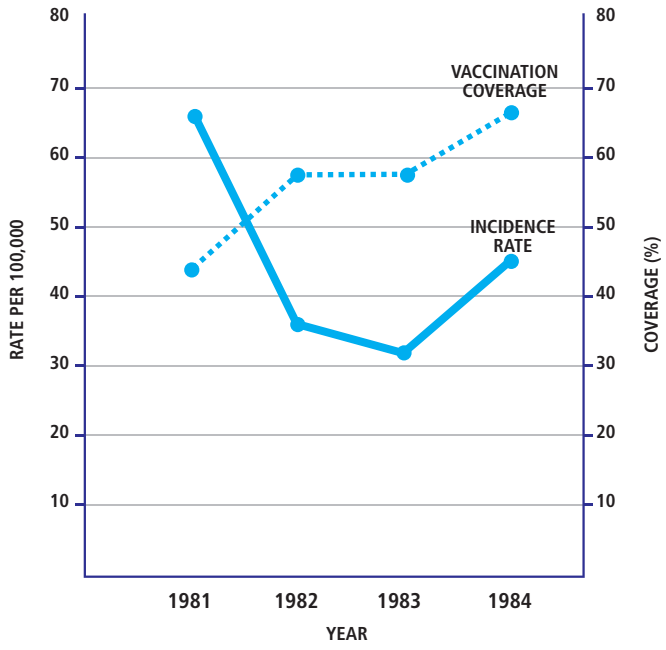
If measles morbidity rates are examined by subregion (Figure 2), it can be seen that rates of disease incidence increased in 1981 in all areas except the Caribbean, with the most marked increase reported by the subregion of temperate South America. Most of the increase here was due to an epidemic of measles which occurred in Argentina in 1981. The number of cases reported by Argentina increased from 7,106 in 1983 to 31,751 in 1984. In the subregion of tropical South America, Brazil reported a marked increase in disease activity, from 58,255 cases reported in 1983 to 78,481 cases in 1984. Other countries in this subregion experienced milder increases. Four of seven countries in the continental subregion reported increased case counts. In general, 1984 appears to have been a year of intensified measles activity in all areas of the Region except the Caribbean subregion.

PAHO assisted the government of Argentina in the investigation of the 1984 measles outbreak. This outbreak followed two years of very low measles incidence in that country. Initial findings suggested than an increased risk of measles was experienced among all age groups, with the highest death-to-case ratios seen in children under 2 years of age. The increase in disease transmission occurred in the face of rising immunization levels, suggesting that pockets of susceptibles may accumulate over time despite apparently good program efforts. Collecting and analyzing information on age and vaccine status of each case has been crucial to targeting efforts to control such outbreaks.

Two examples of successful control efforts should be noted. In Panama, a measles peak was anticipated between November of 1983 and March of 1984 based on a 2-year epidemic cycle and a prior peak which had occurred between December 1981 and March 1982. Surveillance and immunization activities were intensified and the anticipated increase in disease was not seen. In Rio de Janeiro, a national day of measles vaccination for children under age 5 held in May 1985 apparently averted a disease peak in June, July, and August. Hospital admission for measles plummeted by 90% during these months. Such mass vaccination campaigns have proven valuable in preventing epidemics of both measles and polio activity in the Region, providing an additional strategy option for EPI programs.

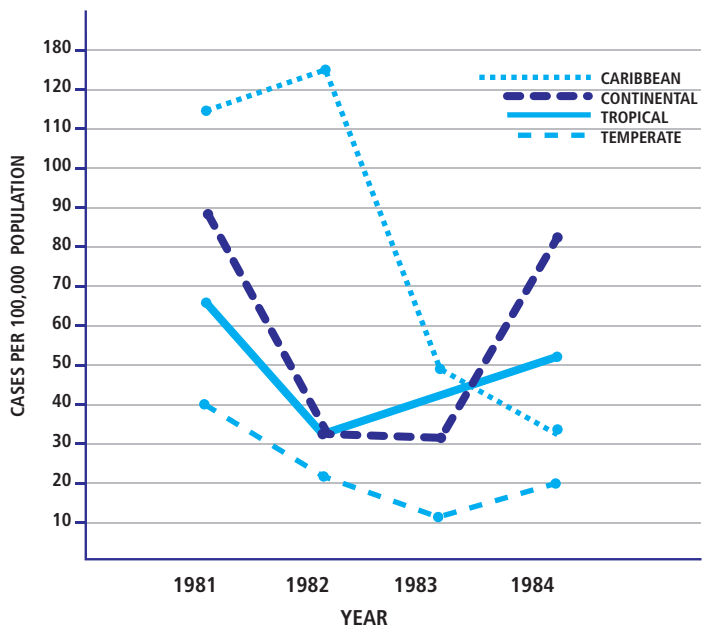
In general, measles is a seasonal disease with increased epidemic activity every two or three years. Because of its high communicability, very high immunization coverage levels are necessary to prevent

FIGURE 1 Measles in the Region of the Americas: Incidence and vaccination coverage, 1981-1984.*



*Excludes U.S. and Canada

FIGURE 2 Measles incidence in the Americas, by subregion, 1981–1984.*



*Excludes U.S. and Canada.

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Panama Increases Measles Surveillance

Measles in the Republic of Panama occurs in a pattern that makes it possible to predict epidemics every two or three years, especially between November and March.

Because the epidemic in Panama from December 1981 to March 1982 was monitored, the last trimester of 1984 was determined to be a high risk period for measles.

Based on this finding, vaccination and surveillance activities were intensified at local and regional levels, including individual case investigation to determine previous vaccination status and guarantee the vaccination of all susceptible children.

During the course of these investigations, a case of measles was defined using the clinical criteria proposed by the Centers for Disease Control in Atlanta (see EPI Newsletter VI-5):

1. *Fever 38.3"C or higher.*
2. *Generalized rash of 3 days or longer.*
3. *At least one of the following: coryza, conjunctivitis or cough.*

Many suspected cases were rejected as non-measles cases by applying these criteria, especially in infants under six months of age and in persons over six years of age.

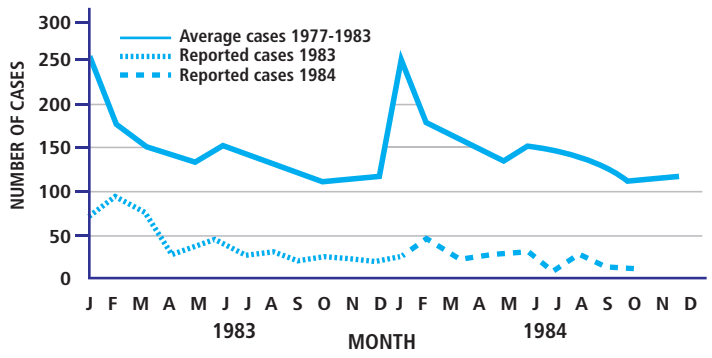
As of October 1984, a total of 338 measles cases had been reported in the Republic of Panama. This represents a reduction of 36% when compared with the same period in 1983.

During the last two years, the monthly number of reported cases in the country has remained below the median of reported cases from 1977 to 1983, (see Figure 1).

A reduction of approximately 80% of reported measles cases was observed during October 1984, for example. This pattern can be partly attributed to the increase of vaccination coverage, which reached 71.6% in children under one year of age during the first trimester of 1984. To avoid a probable measles epidemic, it will be necessary to increase vaccination activities, especially in those under one year of age and in preschoolers, until coverage of over 90% is reached.

Health regions, such as Panama and San Blas in 1982 and Bocas del Toro in 1983, managed to avoid epidemics by means of exhaustive vaccination efforts by regional and local teams.

FIGURE 1 Measles cases by year and month, 1983–1984, Panama.



periodic outbreaks. The experience in North America supports this strategy. As seen in Argentina where coverage is 70%, some infants each year will remain susceptible and outbreak activity will occur when a requisite number of susceptibles is generated over time to support viral transmission. Paraguay and Brazil have demonstrated that periodic mass immunization days directed at appropriate age groups can be valuable in assuring that such an accumulation of susceptibles does not occur in the population.

Age of cases of measles is not routinely reported to the Regional Office although it is recommended that countries collect such information for their own use. Age information at the country, programmatic level allows targeting of efforts to age groups particularly at risk. Non-routine surveillance data and information collected during assistance with outbreak investigations suggest measles continues to be primarily a disease of young children for most of the Region.

It appears that the age of highest disease incidence is modified in the face of elimination efforts such as that underway in the United States where coverage rates are greater than 95%. As incidence declines, sporadic cases begin to be seen among older age groups; this can be seen when the proportion of cases in each age group in the U.S. is compared with that occurring in selected urban centers elsewhere in the Region (Figure 3). Population-based rates in the U.S. showed a rate of 2.6/100,000 for the 0-4 age group and 2.1/100,000 for the 15-19 year-old age group. Rates for all other age groups were far below these rates for this time period. As can be seen for the selected urban centers reporting, measles was rarely seen in the age groups over 15 years; only .02 percent of 5,117 total cases reported occurred in this age group. Population-based rates are not available for these urban centers.

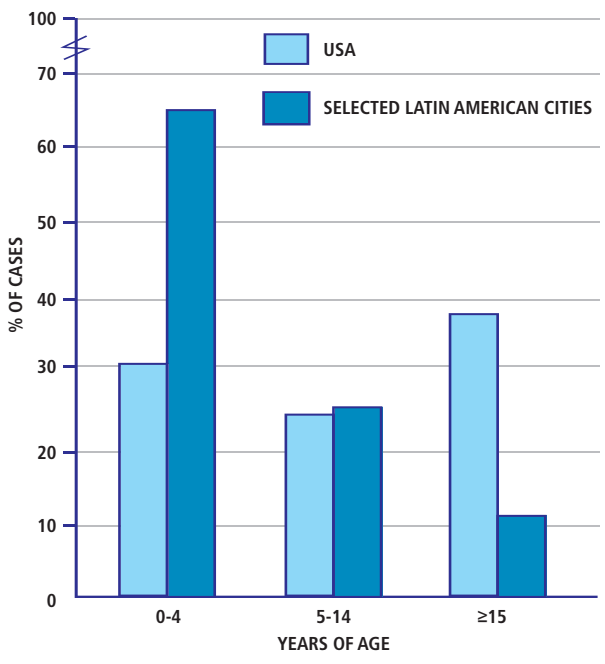
Using current vaccines, it is not recommended to vaccinate earlier than 9 months to prevent measles in infants. A detailed investigation of vaccine efficacy was carried out in Planaltina, Federal District, Brazil, of an outbreak which occurred between January and June of 1983. Because complete age and vaccination status data were kept on cases, it was possible to document a suboptimal vaccine efficacy of 43% for children vaccinated prior to 9 months of age. Thus, despite apparently high coverage levels, transmission was maintained. This supports the recommended minimum age of vaccination of 9 months as suggested by the collaborative Latin American study coordinated by PAHO in 1981-1982.

Measles continues to strike children less than 1 year of age in the Region. Many infants in the Region are contracting measles before they have an opportunity to be protected. This is of particular concern because mortality is inversely related to age. Very young children appear to be particularly affected during epidemic cycles which occur every two or three years. It is, therefore, particularly important to completely document age and vaccination status to facilitate appropriate control strategies. Among the selected urban centers, the proportion of measles cases in infants ranged from 13-30% with an overall proportion of 20% for each of the last 4 years. This, despite the fact that vaccination coverage in 1984 was over 65% for infants in the Region (excluding Canada and the United States). Other age-specific surveillance reporting suggests this persistence of measles among infants is typical of the Region.

Work is ongoing to develop new vaccines which would allow earlier effective immunization against measles of infants younger than 9 months of age. This area of research continues to be of interest to PAHO as the regional EPI program searches for improved methods of measles control.

Source: Excerpted from Health Conditions in the Americas, 1982-1985 (in press).

FIGURE 3 Proportion of measles cases in three age groups: the United States and six urban centers in selected Latin American cities, 1983.



1986

April 1986
Volume VIII, Number 2

Measles: United States, First 26 Weeks, 1985

Through 28 December, 2,704 measles cases in the United States were reported to the Morbidity and Mortality Weekly Report (MMWR) for 1985. Results of detailed analyses are available for cases reported during the first 26 weeks, when a provisional total of 1,802 cases was reported, a 2.4% increase over the 1,759 cases reported during the same period in 1984.[1] The overall incidence rate in both years was 0.8 cases per 100,000 population for the 26-week period. Eight states accounted for 1,333 (73.9%) cases: Illinois (259 cases), Texas (236), Arizona (194), California (143), Montana (139), Idaho (126), New York (124), and Massachusetts, (112). Ten states had incidence rates greater than 1/100,000 population: Arizona, Hawaii, Idaho, Illinois, Maryland, Massachusetts, Montana, Texas, West Virginia, and Wisconsin. During the first half of 1984 and 1985, 19 and 20 states, respectively, reported measles cases (indigenous or imported). For each year, 2.5% of the nation's 3,139 counties reported measles cases during the period.

Detailed information was provided to the Division of Immunization, Center for Prevention Services, CDC, on 1,801 of the cases reported during the first 26 weeks of 1985. Of these, 1,750 (97.2%) met the standard case definition for measles, and 661 (36.7%) were serologically confirmed. In most cases (72%), onset of rash occurred between weeks 8 and 20 (weeks ending February 23 and May 25, respectively). There was a biphasic distribution of cases during this period (Figure 1).

In the first half of 1984, the highest incidence rate was reported among children 10-14 years of age (Table 1). By comparison, the first half of 1985, the highest incidence rate was reported among 15- to 19-years-olds (3.1/100.000), followed by preschool-aged children (2.5/100.000). The incidence rate among 10- to 14-year olds decreased from 2.9/100,000 in 1984 to 1.8/100,000 in 1985. Of the 466 preschool-aged children with measles, 137 (29.4%) were infants under 1 year of age; 81 (17.4%) were 12-14 months of age; 24 (5.2%) were 15 months of age; and 224 (48.1%) were 16 months-4 years of age.

Of the 1,256 (69.7%) patients for whom the setting of transmission was reported, 903 (71.9%) acquired measles in school;[2] 126 (10.0%), at home; 63 (5.0%), in medical settings; 41 (3.3%), in daycare centers; 18 (1.4%), in church, and 105 (8.4%), in a variety of other settings, including sporting events and summer camp.

WHO/1995—WORLD HEALTH DAY 1987 — "Immunization: A Chance for Every Child." To protect: A dose of vaccine at 9 months of age.

FIGURE 1 Reported measles cases, by week of rash onset, United States, first 26 weeks, 1985.

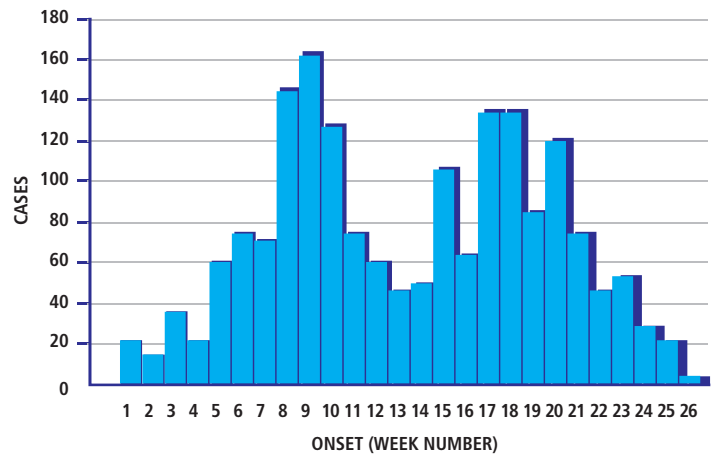


TABLE 1. Age distribution and estimated incidence rates of measles, United States, first 26 weeks, 1984 and 1985.*

Age group (years)	1984			1985			Rate of change (%)
	No.	(%)	Rate[a]	No.	(%)	Rate[a]	
0–4	351	(19.9)	2.0	466	(25.9)	2.5	+25
4–9	201	(11.4)	1.3	152	(8.4)	0.9	-30.8
10–14	515	(29.2)	2.9	319	(17.7)	1.8	-37.9
15–19	470	(26.6)	2.4	603	(33.5)	3.1	+29.2
20–24	137	(7.8)	0.6	175	(9.7)	0.8	+33.3
>25	91	(5.1)	0.1	86	(4.8)	0.1	0,0
Total	**1,765[b]**	**(100.0)**	**0.8**	**1,801**	**(100.0)**	**0.8**	**0.0**

* Provisional data.
a Per 100,000 population.
b The difference between this number and that in the text reflects differences between summary data reported to *MMWR* and more detailed data available from the CDC's Division of Immunization.

Seventy cases (3.9%) were international importations. An additional 128 (7.1%) cases were epidemiologically linked to an international importation within two generations of infection. Therefore, 198 (11.0% of all cases) were classified as international importations during this period.[2]

Vaccination status of patients in 1984 and 1985 was similar. Of the 1,801 cases reported during the first 26 weeks of 1985, 859 of the patients had been vaccinated on or after the first birthday; 247 had been vaccinated at 12-14 months of age (Table 2). A total of 846 measles patients were unvaccinated, and 96 had histories of inadequate vaccination (vaccinated before the first birthday).

Of the 1,801 cases, 466 (25.9%) were classified as preventable[2] (Table 3). The highest proportion of preventable cases occurred among persons who were not of school age: 69.2% of cases among children 16 months-4 years of age were preventable. Only 20.4% of cases among persons 5-19 years of age were preventable; however, 47.0% of all preventable cases occurred in this age group.

Of the 1,335 persons with non-preventable cases, 242 (18.1%)

TABLE 2. Ages of measles patients at most recent vaccination, United States, first 26 weeks, 1984 and 1985.*

Age at vaccination	1984		1985	
	No.	%	No.	%
<12 months	135	(7.6)	96	(5.3)
12–14 months	255	(14.4)	247	(13.7)
15 months	34	(1.9)	46	(2.6)
16 months–4 years	303	(17.2)	325	(18.0)
5–9 years	139	(7.9)	165	(9.2)
10–14 years	32	(1.8)	70	(3.9)
15–19 years	8	(0.5)	5	(0.3)
≥20 years	2	(0.1)	1	(0.1)
Unknown (>12 months)	3	(0.2)	0	(0.0)
Unvaccinated	854	(48.4)	846	(47.0)
Total	1,765	(100.0)	1,801	(100.0)

* Provisional data.

TABLE 3. Age distribution and preventability of measles cases, United States, first 26 weeks, 1985.*

Age group	Preventable		Nonpreventable		Total
	No.	%	No.	%	
<15 months	0	(0.0)	242	(100.0)	242
16 months–4 years	155	(69.2)	69	(30.8)	224
5–9 years	32	(21.1)	120	(78.9)	152
10–14 years	52	(16.3)	267	(83.7)	319
15–19 years	135	(22.4)	468	(77.6)	603
20–24 years	60	(34.3)	115	(65.7)	175
25–29 years	32	(60.4)	21	(39.6)	53
>30 years	0	(0.0)	33	(100.0)	33
Total	466	(25.9)	1,335	(74.1)	1,801

* Provisional data.

TABLE 4. Reasons measles cases were classified as nonpreventable, United States, first 26 weeks, 1985.*

Causes of nonpreventability	No. cases (%)				Percentage of total cases
<16 months			242	(18.1)	13.4
Born before 1957			42	(3.1)	2.3
16 months - 28 years			1,051	(78.7)	(58.4)
Adequately vaccinated	842	(80.1)			
Prior physician diagnosis	11	(1.0)			
Non-U.S. citizens	34	(3.2)			
Exemptions[a]	163	(15.5)			
Laboratory evidence of immunity	1	(0.1)			
Total			1,335	(100.0)	74.1

* Provisional data.
a Medical exemptions-8; religious-150; philosophic-5.

Editorial Note:

In the prevaccine era, an average of 500,000 measles cases was reported each year.[3] After measles vaccine was licensed in 1963, the incidence of measles markedly declined. Since 1981, the number of reported measles cases has remained relatively constant: 3,124 in 1981, 1,714 in 1982, 1,497 in 1983, and 2,543 in 1984. The number of cases reported during the first half of 1985 is similar to that reported during the first half of 1984.[1] As in recent years, measles was geographically restricted: 97.5% of the nation's counties were free of measles during this period.

While incidence rates during the first 26 weeks of 1984 and 1985 were comparable, there were differences in the age characteristics of patients. In 1984, persons 10-14 years of age accounted for approximately 29% of cases, compared with only 18% of cases in 1985. The incidence rate for 15- to 19-years-olds was higher in 1985. Over a third of measles patients were in this age group, due in part to the large number of outbreaks on college campuses in 1985.[4] Colleges and universities are now beginning to require evidence of immunity to measles for matriculation; this requirement should result in a decrease in measles in this population.

As the measles elimination strategy is successfully implemented, the proportion of preventable cases should decrease. The decrease in the percentage of preventable cases from 34.6% in 1984.[1] to 25.2% during the first half of 1985 is encouraging. As in 1984, preschool-aged children over 15 months of age had the highest proportion of preventable cases. Because these children are not reached by existing school laws, greater efforts need to be directed to this age group. School-aged persons accounted for the largest percentage of all preventable cases, and schools were the setting of transmission for the majority of cases. Therefore, continued enforcement of current school immunization laws is important for further reduction of measles in the United States.

were too young for routine vaccination (under 16 months of age), and 42 (3.1%) were too old (born before 1957) (Table 4). Of the 1,051 who were between 16 months and 28 years of age, 842 (80.1%) had been vaccinated on or after the first birthday; 11 (1.0%) had a prior physician diagnosis of measles; 34 (3.2%) were not U.S. citizens; and 163 (15.5%) had medical contraindications or exemptions under state law. One person (0.1%) had laboratory evidence of immunity.

Reported by Division of Immunization, Center for Prevention Services, CDC.

References
1. CDC. Measles-United States, first 26 weeks, 1984. MMWR 33: 495-496, 501-504, 1984.
2. CDC. Classification of measles cases and categorization of measles elimination programs. MMWR 31: 707-711,1982.
3. CDC. Measles surveillance report N.11, 1977-1981. Atlanta, Georgia: Centers for Disease Control,1982.
4. CDC. Measles on college campuses-United States, 1985. MMWR 34: 445-449, 1985.

Source: Morbidity and Mortality Weekly Report (MMWR) 35(1):1-4, 10 Jan 1986.

1 Fever (38.3°C [101° F] or higher, if measured), generalized rash of 3 days' or longer duration and at least one of the following: cough. coryza. conjunctivitis.
2 Includes kindergarten through college.

FIGURE 1 The development and distribution of measles rash.

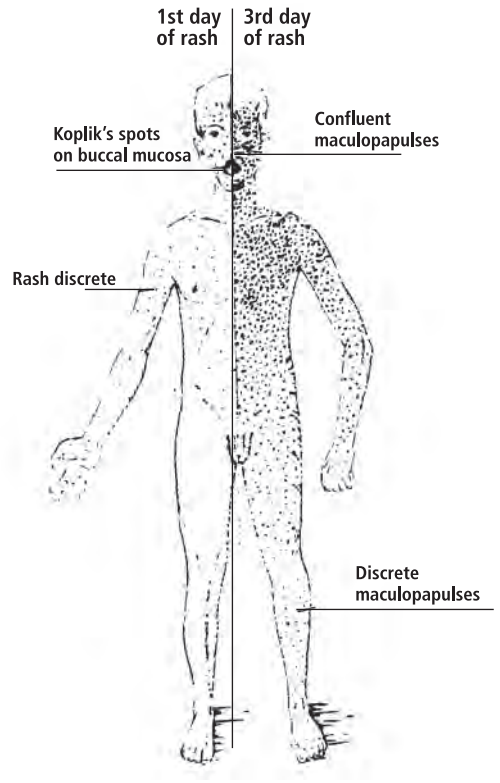


TABLE 1. Measles cases reported to the Hopital del Niño, by type of care received, and by age of occurrence, Panama, 1985.

Type of care	Age								
	0–5 mo.	6–11 mo.	1 yr.	2 yr.	3 yr.	4 yr.	5-9 yr.	10–14 yr.	Total
Outpatient	75	199	181	69	58	54	171	100	907
Hospital	35	118	98	42	23	12	24	27	379
Total	110	317	279	111	81	66	195	127	1286

Source: Administration and Finance Division: Statistics and Records Department, Hospital del Niño.

August 1986
Volume VIII, Number 4

Why is There Measles in Panama?

Measles is an acute, highly contagious, viral disease characterized by fever, conjunctivitis, cough, and spots on the mucous membranes of the mouth (Koplik's spots) followed by a generalized maculopapular eruption, which usually appears on the fourth day of the disease (Figure 1). The rash and accompanying illness reach a climax on about the sixth day, subsiding a few days later, followed by complete recovery in most cases. The disease is most serious in nursing infants and adults. Complications such as pneumonia, otitis media, and encephalitis can arise. Pneumonia is the main cause of death in children with measles, mainly those under 2 years of age.

An effective vaccine against measles has been available since 1963. It prevents the disease in about 95% of the persons vaccinated. The vaccine is stocked and administered free of charge at health institutions around the country.

Current Situation

In 1985, 1,286 children were treated for measles at the Hospital del Niño (Table 1). Of these, 379 had to be hospitalized and 6 died. Judging by the trend of the case curve, an estimated 322 additional children with measles will seek health-care at the Hospital del Nino before the end of this epidemic. Based on the average cost of emergency room care (equivalent to approximately US$ 10) and the daily hospitalization rate (US$ 50), and on an average length of stay of 4.8 days per measles patient in 1985, the measles epidemic will ultimately cost the Hospital del Nino more than US$ 130,000. To this should be added the cost of care at other health care centers in the country and the direct and indirect costs to the families of these children, not to mention the incalculable cost of the suffering and death of Panamanian children.

Vaccine Efficacy and Age of Vaccination

Mathematical models have established that between 93.5% and 96% of the population must be immunized in order to completely eliminate measles transmission. Since the effectiveness of the vaccine is about 95%, it would be necessary to vaccinate virtually 100% of the susceptible population, in keeping with the goals of the World Health Organization.

In order to better understand the epidemiology of the outbreak, it was decided to look at vaccine efficacy and age of vaccination in order to improve control strategies. Based on reports from the Metropolitan Region Epidemiology Department of measles cases and vaccination history, and using the formula to calculate vaccine efficacv (the attack rate in the unvaccinated minus the attack rate in the vaccinated divided by the attack rate in the unvaccinated), the effectiveness of the vaccine was estimated at 90%. This level is at the lower end of the normal limits for measles vaccine efficacy (90% to 98%).

There is disagreement about the ideal age for vaccination. PAHO/WHO, based on studies in Africa, Chile, Brazil, Ecuador, Costa Rica, and Haiti, recommends vaccination at 9 months, whereas the United States has concluded that vaccination should be performed at 15 months of age. Panama has taken an intermediate position by vaccinating at 9 months and revaccinating at 15 months. Also controversial is whether revaccination at 15 months is effective in children vaccinated before 1 year of age.

The age issue is important in Panama since, despite the considerable effort being made and the policy decision to hold national vaccination days, measles remains out of control. Several technical issues are also involved: (1) considerable material and human effort is required to administer two doses of measles vaccine, one at 9 and the other at 15 months; (2) coverage levels are approaching the 100% necessary to interrupt transmission; (3) about one-third of the cases occur in infants under one year of age, when the complications of measles are most severe, and (4) about one-fourth of the cases occur in schoolchildren between 5 and 14 years of age (Figure 2). Cases in the latter age group are particularly important due to the possibility of transmitting the disease to younger children.

Recommendations

Based on the previous analysis, the following steps were recommended to the Ministry of Health:

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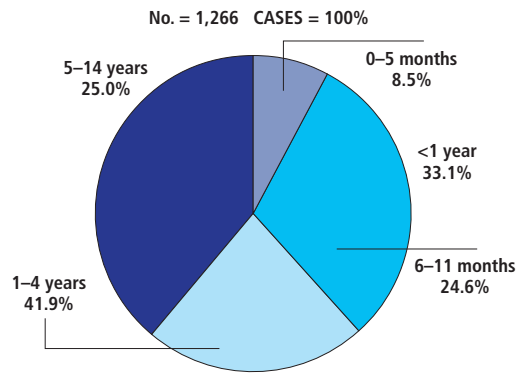
Volume VIII, Number 6

FIGURE 2 Measles cases treated at the Hospital del Niño, by age group, Panama, 1985.



1. Take advantage of all opportunities to vaccinate susceptible children, in the absence of formal contraindications as defined by the Vaccination Norms. This means asking systematically about the measles and vaccination histories of hospitalized children or those seeking medical care. Every susceptible child whose health status does not constitute a formal contraindication to the procedure should be vaccinated, and the fact recorded on his/her vaccination card together with precise instructions that the child is to be taken to the appropriate health center or polyclinic for vaccination followup.
2. Encourage presentation of the vaccination card when requesting medical care at a health establishment, as part of a campaign to promote vaccination and to support the preceding recommendation.
3. Vaccinate all children, regardless of age, who have not been vaccinated and have not had measles, in accordance with the Immunization Manual of the Panamanian Health Ministry.
4. Thoroughly review the existing norms and strategies for vaccination. As part of this review, the following recommendations are made:
   - 4.1 Evaluate the results of national vaccination days in terms of cost-effectiveness (what is the average cost of each vaccination performed on a national vaccination day?) and the epidemiological impact of these days on the control of vaccine-preventable diseases. These evaluations should be done by region and by area, since the strategy might be valid in some areas and regions but not in others.
   - 4.2 Considering the importance of schoolchildren as a source of transmission to younger children, and given the logistical advantages of this captive population, the strategy of systematically requiring a vaccination card for school enrollment should be strengthened. If all public and private schools throughout the country had such a requirement, in 10 years virtually all schoolchildren between 5 and 14 years of age would be vaccinated against measles, and transmission of the disease in Panama would be greatly limited.
   - 4.3 It is important to keep in mind the future of children who are now between 5 and 14 years of age and who have not had measles or been vaccinated against it. Most will probably grow up without immunity. Later on, there may be outbreaks in universities and workplaces with serious consequences, including death.

   The current epidemic yields disquieting data on the number of children with measles who are under 6 months of age. Several newborns have contracted measles within a few days of birth; some of them were born to women who had contracted measles during pregnancy. Nearly 10% of the cases treated at the Hospital del Niño were children under 6 months of age. The occurrence of measles in a normal child under the age of 6 months means that the mother had no immunity against measles. This represents a change from the situation in earlier years, when cases of measles in newborns were rare, except in indigenous communities which had been shielded from measles by their isolation, so that when measles did strike, it hit adults and children alike.

   Consequently, it is recommended to consider and evaluate the strategy of mass vaccination in the schools of all schoolchildren between the ages of 5 and 14 who do not produce documented proof of having been vaccinated against measles or of having had the disease. Considering the benefits of vaccination, its safety, and the lower cost of the vaccine in 10-dose vials, it would be preferable to vaccinate some children who are already immune rather than to fail to vaccinate a susceptible child.
   - 4.4 Vaccination norms should be reviewed, particularly with regard to the age for measles vaccination. Particularly disquieting is the possibility that revaccination has little effect on children who did not respond to the first dose. This requires a serious examination of the benefits and drawbacks of lowering the vaccination age to 6 months, despite the large number of cases in this age group. A good alternative would be to investigate how, where, and from whom infants under 1 year are infected, so as to direct vaccination at the sources of transmission. This would provide the protection needed by infants under 1 year until they reach an age at which they will be sure to respond adequately to the vaccine. Moreover, during intervals between epidemics the risk of contracting measles for infants under one year of age is minimal, and the opportunity offered by those intervals. should be used to vaccinate all children at the right age for vaccination, not at 6 months.
5. All these recommendations should be considered in light of the awareness, desires, and motivations of the community.

Source: Based on article by Dr. Claude D. Betts, Boletin Epidemiol6gico, Hospital del Niño, Republic of Panama, Vol. 1, No. 2, Nov-Dec, 1985.

1 Hinman. A.R., Kirby. CD., et al. Elimination of Indigenous Measles from the United States, in Reviews of Infectious Diseases 5(3):542. May-June 1983.

2 Ministries of Health of Brazil, Chile, Costa Rica, and Ecuador and the Pan American Health Organization. Seroconversion Rates and Measles Antibody Titers Induced by Measles Vaccination in Latin American Children 6 to 12 Months of Age, in *Reviews of Infectious Diseases* 5(3):590:605. May-June 1983.

TABLE 1. Measles transmission through attending a health unit, relationship between time elapsed since last clinic consultation and stage of measles, Ivory Coast, 1985[a].

Stage of measles	Time in days since last consultation											Total exposed
	11	12	13	14	15	16	17	18	19	20	>30	
Koplik spots	4	1	3								(3)	8/11
Head	1		2	3		1	1		(1)	(1)	(5)	8/15
Neck-shoulders			4	3	2	2					(3)	11/14
Abdomen		(2)	2	4	4	5	1	1		(1)	(2)	17/22
General				3		1				1	(2)	5/7
Desquamation										1	-	1/1
TOTAL						55					(15)	50/70

a Figures in parenthesis: subjects not exposed.

TABLE 2. Attributable risk to attending health unit, measles patients and controls, by age and immunization status, Ivory Coast, 1985.

	Measles patients		Controls		χ^2	p	OR	CI	AR
Immunized	E (1) 4	NE (2) 2	E (1) 3	NE (2) 22	(3) –	10^{-2}	(4) 11.6	(5) (1.7–78.3)	(6) 0.52
Unimmunized	46	18	–	21	39.2	10^{-6}	–	–	0.81
<9 months	18	5	–	16	23.3	10^{-6}	–	–	0.84
9–11 months	12	4	1	9	10.4	10^{-2}	17.6	(2.3-134)	0.65
≥12 months	20	11	2	18	14.7	10^{-3}	13.2	(2.9-59.4)	0.54
TOTAL	50	20	3	43	47.1	10^{-8}	30.6	(9.2-102)	0.67

(1) Exposed.
(2) Not exposed.
(3) χ^2 test, or Fisher's exact test = Log OR ± 1.96 (1/a+1/b+1/c+1/d)½.
(4) Odds ratio: OR = ad/bc.
(5)Confidence interval: Log (CI_1 CI_2 = Log OR ± 1.96 (1/a+1/b+1/c+1/d)$^{1/2}$.
(6) Attributable risk: AR = P (E) (RR-1)+ 1).

Editorial Note:

Studies such as the one described above are useful for policy makers considering whether to recommend a different vaccination schedule in light of changing disease epidemiology. In the United States, measles vaccination is routinely performed at 15 months of age because measles infection during the first year of life is unusual, and studies have shown that vaccination at earlier ages does not yield as high a rate of seroconversion in U.S. children as it does in children from the rest of the world.[1] In many African countries, on the other hand, substantial measles morbidity and mortality have been found in children younger than 9 months.

A PAHO/WHO collaborative study in several Latin American countries suggests that 90% seroconversion can be attained if initial vaccination is given at 9 to 11 months of age.[2] Consequently, PAHO continues to recommend that most countries vaccinate at 9 months of age, concentrating their resources on achieving as close as possible to 100% coverage with one dose before the first birthday.

Nosocomial Measles

Although nosocomial transmission of measles among children attending pediatric clinics is well known, no quantitative study including a control group has been reported.

In 1985, a study of this kind was carried out in a maternal and child health clinic on the outskirts of Abidjan (Ivory Coast) where 11,000 children are seen each month. The clinical criteria for identifying measles patients were: oculo-respiratory catarrh with Koplik's spots or typical rash. Patients with measles were paired with patients of the same age selected from other children attending the clinic for an illness other than measles. In the measles patients the probable date of infection was determined by the stage of the rash at the time of examination, on the basis of predefined criteria.

Measles patients who attended the clinic on a date compatible with the probable date of their infection, together with those controls who had attended the clinic 8-21 days earlier, were considered to have been exposed.

The statistical analysis was performed for (a) the entire population; (b) the immunized population; (c) the unimmunized population and each of three age groups (<9 months, 9-11 months, ≥12 months). The relationship between measles and exposure was studied by means of the χ^2 test when the expected cell sizes were sufficiently large or by the Fisher's exact test. The relative risk (RR) was estimated from the odds ratio (Ψ); the confidence interval for the RR was estimated by Cornfield's method. The attributable risk of measles to attending the health unit was calculated in the light of the frequency of the disease among the patients attending the clinic.

Results

A total of 140 children were included in the study (70 with measles and 70 controls). Of the 70 measles patients, 55 had visited the clinic 8-21 days earlier (Table 1), and 50 were considered to have been exposed during that visit. Twenty-four controls out of 70 had a history of measles and were therefore excluded from the study; of the remaining 46.3 had attended the clinic 8-21 days earlier (Table 2). The proportion of clinic attendees is significantly lower among the controls than among measles patients (3 out of 46 as against 50 out of 70; χ^2= 47.1, p< 10^8). The relative risk is estimated at 30.6 (9.2 to 102 at 5% risk). In view of the frequency of the disease among clinic attendees (10% during an outbreak), the proportion of clinic patients exposed can be estimated to be 13%, on the basis of the study

TABLE 3. Reason for previous consultation by measles patients and controls, Ivory Coast, 1985.

Reason for previous consultation	Measles patients	Controls	Total
Routine visit	5	13	18
Acute disease[a]	63	30	93
TOTAL	68	43	111

a Malaria: 24 measles patients, 16 controls.
Pneumopathy: 13 measles patients. 3 controls.
Diarrhea: 17 measles patients. 7 controls.
Other: measles patients, 4 controls.

findings. The corresponding attributable risk is 67%.

The estimates are similar for unimmunized subjects (64 with measles and 21 controls). The age distribution of the two groups does not differ significantly. The frequency of exposure is significantly lower among the controls than among the measles patients (0 out of 21 as against 46 out of 64; $\chi^2 = 39.2$, $p < 10^{-6}$). The odds ratio was not calculated since no controls were exposed. In view of the proportion of clinic patients exposed (13%), the attributable risk is 81%.

The reason for the previous visit was recalled by 111 of the mothers (68 mothers of measles patients and 43 mothers of controls) (Table 3). This information gives an indication of the profiles of the patients most exposed to the risk of measles of nosocomial origin. The frequency of routine visits was significantly lower among measles patients than among controls (5 out of 68 as against 13 out of 43; $\chi^2 = 10.2$, $p<0.01$).

Analysis of the Findings

Although the survey was carried out at the end of an epidemic, the results showed that two-thirds of the measles cases treated in this clinic were of nosocomial origin.

It might be expected that in epidemic periods, measles would spread even more among clinic patients. Because of the way out-patient care is organized, infants are all exposed to the virus in the waiting-room. However, evaluation of immunization coverage among this population showed that 64% were immunized against measles. The Ivory Coast was one of the first countries to perform routine immunization of moderately febrile children in accordance with WHO recommendations.

Some clinic attendees still go unimmunized and are particularly at risk: infants under 9 months, and children visiting the clinic occasionally who had a temperature of over 39°C on the immunization day.

Recommendations

Routine immunization of clinic patients, including those with fever, would reduce the frequency of nosocomial transmission of measles.

Research on a measles vaccine that could be administered before the age of 9 months should be promoted. Wherever possible the clinic's reception procedures should be improved, so that measles patients are quickly identified and kept away from the waiting rooms.

Source: Weekly Epidemiological Record (61)44:338-340, 31 October 1986. (Article based on a report scheduled for publication in WHO Bulletin. Vol. 65 (1987).

1987

April 1987
Volume IX, Number 2

Fourth Meeting of the EPI Technical Advisory Group (TAG) in the Americas

In the seven months since the Third Meeting of the Technical Advisory Group (TAG) in Brasilia, major efforts were devoted to securing the necessary external resources to carry out the eradication program. This has now been achieved, and commitments or pledges have been made that will provide more than US$ 50 million to support the eradication program in the period 1986-1990. This total includes US$ 20.6 million from USAID (in addition to substantial funds to be supplied in direct bilateral support), US$ 16 million from UNICEF, US$ 15 million from Rotary International, US$ 7 million from PAHO, and US$ 5.5 million from the Inter-American Development Bank.

Other important accomplishments since the Third TAG Meeting include the completion of the Laboratory Manual and the Field Guide, which is ready for publication. A course in surveillance and investigation of poliomyelitis has been conducted in Brazil with participants from 14 countries. In addition, a course in serological and virological techniques in polio diagnosis was conducted in Brazil and attended by personnel from 14 different countries. At the end of the course, participants received small quantities of cell lines, antisera, reagents, and supplies necessary to carry out these studies. Six laboratories (Argentina, Brazil, Colombia, Guatemala [INCAP], Mexico, Trinidad and Tobago, and [CAREC]) have been identified to serve as sub-Regional reference laboratories and a specialized course will be conducted in Atlanta in September, 1987. Supplies and equipment are being ordered for these laboratories and should be in place before the end of the year. Efforts are underway to recruit four subregional epidemiologists (to be located in Brazil, Honduras, Mexico, and Haiti).

The Interagency Coordinating Group met in January and found that, although there was good coordination of activities at the regional level, there were still problems of coordination at the country level. They recommended the formation of coordinating committees in each country and the full involvement of these committees in the development and implementation of national plans of action. Such activities are now in progress. In the country work plans now being developed, issues of financial commitment and accountability are being addressed directly.

Several National Vaccination Days have been held since the last TAG meeting and, in a good example of multinational coordination, the Central American republics held a Central American Vaccination Day on 5 April. An important feature of this activity was a joint television appearance by the Presidents of the various countries.

Against this background, the Fourth Meeting of the TAG was held in Antigua, Guatemala, April 20-22, 1987. The meeting was inaugurated by Dr. Carlos Armando Soto Gomez, Minister of Health and Social Welfare, and Dr. Fernando Antezana, PAHO/WHO Country Representative. The meeting was chaired by Dr. D.A. Henderson; Dr. Alan Hinman served as rapporteur. The following represents a brief summary of the main agenda items and the conclusions and recommendations of the TAG regarding measles:

- Review of official country guidelines for contraindications. This should be combined with efforts to ensure official adoption of the guidelines issued by EPI and endorsed by the Latin American Pediatric Association.
- Identification of the percentage of children visiting health facilities who are eligible to receive immunizations but who are not vaccinated and the reasons for withholding vaccines.
- Development of techniques to evaluate the effectiveness and efficiency of National Vaccination Days.
- Comparison of the efficacy of Edmonston-Zagreb (E-Z) and Chicken Allantoic Membrane (CAM) measles vaccines in infants 6 to 9 months of age.
- Evaluation of efficacy of alternative measles immunization strategies (e.g. 2-dose strategies or mass campaign strategies).

October 1987
Volume IX, Number 5

Expanded Program on Immunization and Nutrition: Joint WHO/UNICEF Statement on Vitamin A for Measles

Evidence mounts that measles is an important risk factor for the development of severe vitamin A deficiency and blindness in Africa as well as in some of the most densely populated countries of Asia. Vitamin A status at the time of measles infection also seems to be critical to outcome.

Measles kills two million children each year, accounting for more than half of deaths attributable to the six EPI target diseases. In regions where the disease is most severe, community studies consistently have shown case fatality rates of over one percent. Death is associated with serious secondary complications such as diarrhea, pneumonia, protein-energy malnutrition, and blindness.

Impact of Measles on Vitamin A Status

Measles depletes vitamin A reserves by markedly increasing utilization at the same time as dietary intake and absorption are reduced. Previously marginal vitamin A stores in the liver of malnourished children are rapidly exhausted. In Thailand, a third of children with measles had serum vitamin A concentrations below 0.35 umol/l (10 ug/dl), a level at which there is very high risk of developing corneal ulcers. In Indonesia, children who had measles during the preceding four weeks were two times more likely to develop corneal xerophthalmia than children who had not had measles.

By depleting vitamin A, measles can precipitate rapid deterioration of the cornea and blindness. The mechanism differs from the direct invasion of the cornea by either measles or herpes simplex viruses, which also cause blindness in some malnourished children.

The dimensions of the post-measles blindness problem in Africa alone are considerable. Thus half the number of children in schools for the blind in Tanzania and Malawi give a history of measles immediately preceding the blinding episode. In Africa as a whole, where the attack rate for corneal damage following measles can reach 4%, corneal scarring accounts for the majority of childhood blindness.

Vitamin A Status and Survival in Childhood

To what extent does vitamin A deficiency increase morbidity and mortality?

First, 50 to 80% of children with blindness associated with vitamin A deficiency are dead within a few months of the blinding episode.

Second, in a recent Indonesian report even mild signs of vitamin A deficiency in preschool-age children were associated with a fourfold increase in mortality; incidence of diarrhea and respiratory disease was increased two to threefold.

Third, in a randomized controlled community trial in Indonesia, childhood mortality was approximately 30% lower in preschool children supplemented with large, oral doses of vitamin A.

The Advisory Group on Nutrition to the Sub-Committee on Nutrition (SCN) of the UN Admininistrative Committee on Coordination concluded that "there is justification to expect that effects of this magnitude would be seen in other settings with similar conditions, including at least similar severity of vitamin A deficiency with associated xerophthalmia, similar high prevalence of childhood morbidity and mortality and similar effectiveness of the xerophthalmia control program." Furthermore, the SCN decided that a beneficial effect on child mortality was a likely additional expectation from vitamin A supplementation programs mounted for the control of xerophthalmia.

Mortality associated specifically with measles may also be greatly reduced by supplying adequate vitamin A. A clinical trial in Tanzania of children admitted to the hospital with measles has looked at the effects of large, oral dose supplements of vitamin A on mortality. Children given 200,000 international units (IU) of vitamin A on two successive

days were less likely to die than children given routine treatment. Mortality was twice as high in the control group (13%) as the supplemented group (7%), the greatest difference being in children under the age of 2 years.

Action Recommended

Present evidence suggests that improvement of vitamin A status may reduce morbidity and mortality rates among children of preschool-age in all communities where vitamin A deficiency exists. Further community assessments may be needed to determine the priority of introducing vitamin A intervention programs for all young children in such communities. One such intervention is routine high dose supplementation, the benefits of which appear to be substantial in children with marginal vitamin A stores.

High-dose vitamin A supplementation should be provided to all children diagnosed with measles in communities in which vitamin A deficiency is a recognized problem. In countries where the fatality rate of measles is 1% or higher it is sensible on the basis of current evidence to provide vitamin A supplements to all children diagnosed with measles.

The dose of vitamin A should be 100,000 IU, by mouth, in children below 12 months of age, and 200,000 IU in children above the age of one year. The dose should be administered immediately on the diagnosis of measles if any of the eye signs of vitamin A deficiency are present, the initial dose should be repeated the next day and again one to four weeks later.

1988

October 1988
Volume X, Number 5

Measles in the United States, 1987

Introduction

In 1987, a provisional total of 3,655 measles cases was reported to CDC, a 42% decrease from the 6,282 cases reported in 1986[1] (Figure 1). The 1987 incidence rate was 1.5 cases/100,000 population, compared with 2.7 cases/100,000 population in 1986.

Detailed information was provided to CDC's Division of Immunization, Center for Prevention Services, on 3,652 cases. Of these, 3,312 (90.7%) met the standard clinical case definition for measles, and 1,106 (30.3%) were serologically confirmed. The usual seasonal pattern was observed, with the peak number of cases occurring from February through May (weeks 4-24) (Figure 2).

There were 76 outbreaks (i.e., five or more epidemiologically related cases), which accounted for 3,165 (86.7%) cases. Seven outbreaks with more than 100 cases each accounted for 1,877 (51.4%) cases. Eighty-three cases (2.3%) were known to be imported from other countries. Of these, 44 were in U.S. citizens. An additional 88 (2.4%) cases were epidemiologically linked to imported cases within two generations of onset in the index patient.

In 1,065 (19.2%) cases, the patients were 5 years of age (Table 1); 482 (13.2%) were 15 months of age (297 children 12 months of age, 185 children 12-14 months of age). The 15 to 19 year age group accounted for 28.7% of all cases. The incidence rate of measles decreased from 1986 to 1987 in all age groups. The highest incidence rates occurred in 0-4 year-olds and 15-19 year-olds.

Complications were reported in 445 (12.2%) cases. Otitis media was reported in 209 (5.7%) cases; diarrhea, in 159 (4.4%); pneumonia, in 91 (2.5%); and encephalitis, in 5 (0.1%). Two hundred eighty-four (7.8%) of the reported patients were hospitalized. Four measles-attributable deaths were reported (death-to-case ratio of 1.1 deaths per 1,000 cases).[2,3]

Of the 2,451 (67.1%) patients for whom setting of transmission was reported, 1296 (52.9%) acquired measles in primary or secondary schools; 153 (6.2%), in medical settings; 141 (5.8%), in colleges or universities; 72 (2.9%), in child day care; 503 (2.0%), at home; and 286 (11.7%), in a variety of other settings.

A total of 1,734 (47.5%) patients had been vaccinated on or after the first birthday, including 609 (16.7%) who were vaccinated at 12-14 months of age. One hundred sixty-nine (4.6%) had a history of vaccination before the first birthday, and 1,749 (47.9%) were unvaccinated. Of the 2,101 schoolaged children 5-19 years of age, 1,506 (71.7%) had been adequately vaccinated, including 579 (27.6%) who were vaccinated at 12-14 months of age. In contrast, of the 1,065 preschool-aged children 0-4 years of age, 153 (14.4%) had been adequately vaccinated, including 20 (1.9%) vaccinated at 12-14 months of age (Table 2).

Measles cases are classified as preventable or non-preventable. A case is defined as preventable if it occurs in a person for whom vaccine is indicated by current recommendations.[4,5] Of the 3652 cases, 1010 (27.7%) were classified as preventable[4] (Table 2). From 1986 to 1987, the absolute number and proportion of cases that were preventable through vaccination decreased in all age groups except those 25 years of age. The highest proportion of cases that were preventable through vaccination occurred in adults 25-29 years old and in children 16 months to 4 years old.

In contrast, fewer than one fifth of cases in school-age children 5-19 years of age were preventable through vaccination. However, 40.1% of all preventable cases occurred in this age group.

TABLE 1. Age distribution and estimated incidence rates* of measles, United States, 1986 and 1987.

AGE (yrs.)	1986			1987[a]			% CHANGE
	No.	%	Rate	No.	%	Rate	
0-4	2,454	(39.2)	13.0	1,065	(29.2)	5.9	-54.6
5-9	675	(10.8)	3.9	337	(9.2)	1.9	-51.3
10-14	1,313	(21.0)	8.1	717	(19.6)	4.3	-46.9
15-19	1,168	(18.7)	6.3	1,047	(28.7)	5.6	-11.1
20-24	290	(4.6)	1.4	205	(5.6)	1.0	-28.6
>25	336	(5.4)	0.3	281	(7.7)	0.2	-33.3
Unknown	19	(0.3)	-	-	-	-	
Total	6,255	(100.0)	2.7	3,652	(100.0)	1.5	-44.4

* Cases per 100,000 population.
a Provisional data.

TABLE 2. Age distribution and preventability of measles cases, United States, 1986 and 1987.

AGE	1986[1]			1987*		
	Total	Preventable		Total	Preventable	
		No.	%		No.	%
< 15 months	1,229	0		526	0	
16 months-4 years	1,225	1,019	(83.2)	539	345	(64.0)
5-9 years	675	237	(35.1)	337	64	(19.0)
10-14 years	1,313	318	(24.2)	717	117	(16.3)
15-19 years	1,168	372	(31.8)	1,047	224	(21.4)
20-24 years	290	213	(73.4)	205	124	(60.5)
25-29 years	170	119	(70.0)	146	127	(87.0)
30 or more years	166	0		135	9	(6.7)
Total	6,236	2,278	(36.5)	3,652	1,010	(27.7)

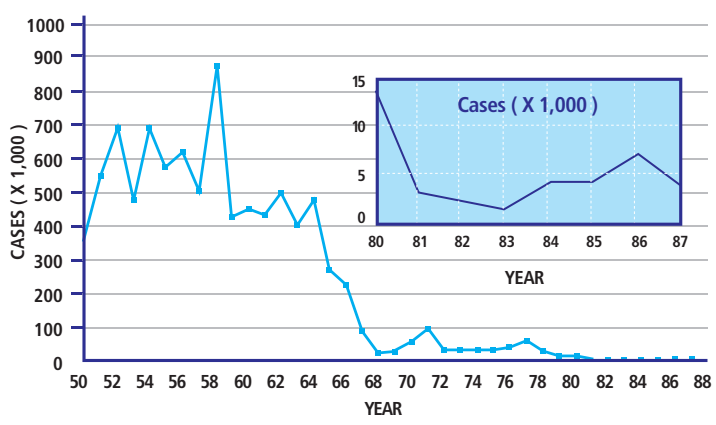
* Provisional data.
[1] In 1986, preventability status is not known for 19 cases.

TABLE 3. Classification of measles cases, United States, 1987.

Classification	No.	% Total	% Non-preventable
Non-preventable			
Persons < 16 months	526	14.4	19.9
Persons born before 1957	126	3.5	4.8
Adequately vaccinated[1]	1,718	47.0	65.0
Prior physician diagnosis	11	0.3	0.4
Non-U.S. citizens	45	1.2	1.7
Exemptions	216	5.9	8.2
Medical (22)			
Religious (50)			
Philosophic (108)			
Nonspecific (27)			
Subtotal	2,642	72.3	100.0
Preventable	1,010	27.7	100.0
Total	3,652	100.0	

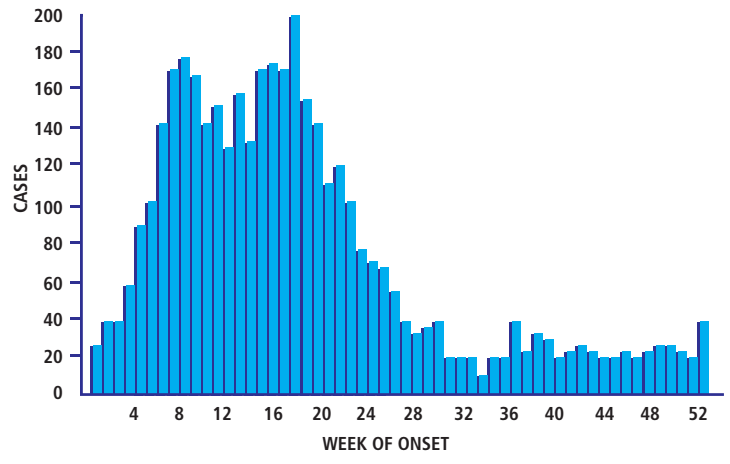
* Provisional data.
[1] Does not include four adequately vaccinated patients born before 1957 and 12 adequately vaccinated patients under 16 months of age.

FIGURE 1 Measles, by year, United States, 1950–1987.



Source: Morbidity and Mortality Weekly Report, Vol. 37, No. 34, September 2, 1988, pg. 527.

FIGURE 2 Measles cases by week of rash onset, United States, 1987.



Discussion

The decrease in number of cases reported in 1987 reverses the trend of annual increases in measles incidence since the record-low year 1983, when 1,497 cases were reported. The number of cases reported in 1987 represents a 99% reduction from the pre-vaccine era. Incidence rates in 1987 decreased from 1986 in all age groups; the largest decrease was in children 5 years of age. The overall decline observed in 1987 has continued into 1988; the provisional 1988 case count through week 27 is approximately 40% below the 1987 level. Reasons for the decline in measles may be multiple; secular trends, exhaustion of susceptibles in some areas from which large numbers of cases have previously been reported, or fewer importations in 1987.

As in previous years, almost one-third of cases reported

A total of 2,642 cases were classified as non-preventable. Of these, 1,718 (65.0%) were in persons who had been vaccinated on or after the first birthday; 526 (19.9%) were in children too young for routine vaccination (16 months of age); 216 (8.2%) were in persons with medical contraindications or exemptions under state law; 126 (4.8%) were in persons older than the recommended age for vaccination (born before 1957); 45 (1.7%) were international importations in non-U.S. citizens; and 11 (0.4%) were in persons with a prior physician diagnosis of measles (Table 3).

were classified as preventable, i.e., patients were eligible for vaccination but unvaccinated. Many of these cases occurred in preschool-age children living in inner-city areas. Innovative strategies are needed to increase immunization levels in these populations.

Most cases reported in 1987, however, were classified as non-preventable and occurred in school-aged children who had been vaccinated on or after the first birthday. Most of these cases probably result from primary vaccine failure, i.e., the failure to seroconvert following vaccination; there is little epidemiologic evidence

to indicate that a secondary vaccine failure rate of 5% (range 2%-10%) may provide enough susceptibles to sustain an outbreak among highly vaccinated populations[6] in some settings. Moreover, persons vaccinated at 12-14 months of age at a slightly higher risk for measles than are persons vaccinated at 15 months.[7]

The four deaths reported in 1987 are the first measles-attributable deaths reported to the Division of Immunization since 1985. All deaths occurred in immunocompromised patients, including two children with AIDS. Since large measles outbreaks have occurred in areas with a high prevalence of human immunodeficiency virus (HIV) infections and since HIV-infected persons appear to be at increased risk for serious complications,[3] the Immunization Practices Advisory Committee (ACIP) recommends that asymptomatic HIV-infected children be vaccinated with measles, mumps, and rubella (MMR) vaccine and that consideration be given to vaccinating symptomatic HIV-infected children.[8]

A group of expert consultants was recently convened by CDC to consider the problem of continuing measles transmission in the United States. The consultants felt that the goal of measles elimination should be pursued. They reviewed the two predominant patterns of measles: 1) measles in unvaccinated preschool-aged children - a failure to implement the current strategy, and 2) infections in adequately vaccinated school-children - a failure of the current strategy. These two patterns require different solutions. Increased efforts are needed to vaccinate preschool-aged children. Vaccination schedules may need to be modified in selected high-risk areas. Proposed changes include lowering the recommended age for routine vaccination and/or instituting a two-dose schedule. Aggressive revaccination strategies may also be necessary to control outbreaks among highly vaccinated school-age populations. These recommendations are being evaluated by ACIP. In the meantime, efforts should continue to ensure that all susceptible persons are vaccinated and that appropriate surveillance and outbreak-control procedures are practiced.

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Source: CDC. Measles - United States, 1987. MMWR 1988; 37:527-31.

December 1988
Volume X, Number 6

Measles Vaccines

Preliminary studies carried out in Mexico, the Gambia, and other countries, suggested that the Edmonston Zagreb strain of measles vaccine, resulted in higher seroconversion rates in the presence of maternal antibodies than the commonly used Schwarz strain, and that increasing the amount of virus administered, regardless of the strain, could also overcome maternal antibody and improve seroconversion at younger ages.

At present, there are a number of studies being done to evaluate the effects of measles vaccine strain and dose on seroconversion. Preliminary results were presented at a workshop in Washington D.C. in September and at the recent EPI Global Advisory Group (GAG) Meeting held in Abdijan, Ivory Coast in October (see *EPI Newsletter,* October, 1988).

Most studies evaluated vaccination at approximately 6 months of age, and although sample sizes, number of study groups, laboratory methods, and vaccines varied substantially from study to study, some tentative inferences can be made:

- the higher the titer of Schwarz strain measles vaccine, the better the rate of seroconversion.
- Edmonston Zagreb vaccine at high and medium titers appeared to induce higher seroconversion rates than Schwarz in the presence of maternal antibodies.

The GAG, after reviewing a summary of these data concluded that while the results were encouraging, a number of questions still required answers. The available information did not yet warrant a recommendation to administer routinely higher potency measles vaccines or different strains to infants younger than 9 months of age. In part, this was because current studies have not been fully analyzed. Achieving high coverage with standard doses of current measles vaccines at 9 months of age is the number one priority. Nevertheless, the GAG called for operational research in some selected urban areas where the incidence rates of measles in infants under 9 months of age is high.

1989

April 1989
Volume XI, Number 2

Measles Elimination in Canada

Surveillance Summary

In 1987, 2,412 measles cases were reported in Canada (94.1 cases per 100,000 population). This total is 84% less than the 14,136 cases reported in 1986. It is also the lowest number recorded since 1983, and only 3% of the incidence observed in the prevaccine era (Figures 1 and 2).

Although official measles mortality data for 1987 are not yet available, preliminary information indicates that no deaths occurred. The last measles death, which occurred in an Ontario preschooler, was reported in 1984.

The clinical case definition, i.e., a person who has fever of 38.3°C (101°F) or higher, cough, coryza or conjunctivitis followed by generalized rash for at least three days - approved by provincial and territorial epidemiologists in late 1987- was not always used nationwide in 1987. Most often cases were reported as physician-diagnosed, although in some jurisdictions, further verification using certain diagnostic criteria was carried out by public health officials.

Elimination Statement

"Eliminalion of measles in Canada is a desirable and feasible goal. Since the introduction of measles vaccine in Canada in 1963, there has been a marked reduction in reported measles incidence, but local epidemics have continued to occur. Because an effective vaccine is available and because there is no non-human reservoir or source of infection, measles elimination within a population is possible if high rates (greater than 95%) of immunization are maintained."

"The major components of a measles elimination program include:

a) achievement and maintenance of high immunization rates and documented proof of immunity in the entire population at risk;"

In recent years, immunization coverage among school children across Canada has reached an all time high. After catch-up immunization for school entrants, their measles immunization rate ranges from 95 to 100%. The ratea mong eligible preschoolers over age 2 is lower, but available data suggest that it may be in excess of 85%.

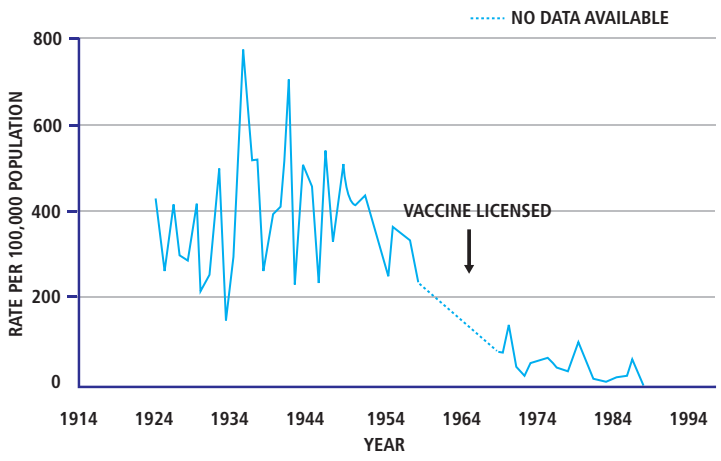
"Maintenance of high levels of immunization (more than 95%) requires strenuous effort to immunize all children as soon as possible after their first birthday and documented proof of immunity for all children on entry to day care centers, schools or similar settings... In jurisdictions where voluntary programs are not effective, legislation should be introduced to require documented proof of immunity to measles before entry to day care, preschool or school and university systems is permitted. Catch-up immunization or re-immunization programs for older school children and young adults who have not been adequately immunized in the past are particularly important and recommended. These programs should be implemented before those susceptible to measles have completed their education and are no longer easily accessible. MMR vaccine may be used for programs of this type and may safely be given to persons already immune to any of the components of MMR vaccines."

b) "intensive surveillance and rapid reporting of all suspected measles cases;"

More careful and intensive surveillance becomes necessary as Canada moves toward elimination of measles. It is important to implement the uniform case definition adopted by the Advisory Committee on Epidemiology.

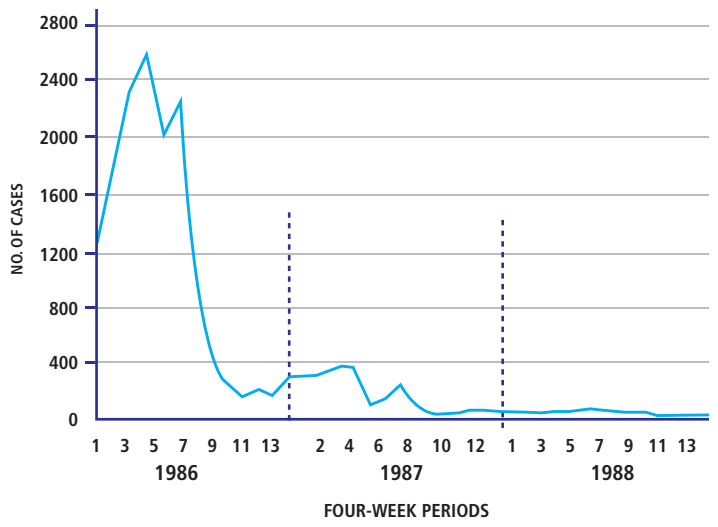
In order to determine whether current immunization recommendations are adequate for achieving elimination, it is essential to determine the preventability

FIGURE 1 Measles reported incidence, Canada, 1914–1987.



Source: Canada Diseases Weekly Report, Vol. 15 - 1, 1989.

FIGURE 2 Measles reported cases by four-week periods, Canada, 1986–1988.



Source: Canada Diseases Weekly Report, Vol. 15 - 1, 1989.

status of measles cases according to current criteria as specified in the above surveillance summary. This means collecting data regarding age, country of usual residence, date of measles immunization or reason for not being immunized. The absolute number and proportion of measles cases which are preventable show how well current immunization recommendations are being implemented. If the number or proportion of measles cases which are currently considered non-preventable remains unacceptably high, other immunization and control strategies will have to be considered.

c) "prompt outbreak control measures designed to prevent spread from index cases to susceptible contacts."

In order to immunize or exclude susceptibles from daycare or school in the event of an outbreak, it is important to identify them quickly. Keeping immunization records for day-care and school populations up-to-date and readily accessible allows rapid identification of susceptibles in the event of an outbreak.

Conclusion

Worldwide, "an estimated 2 million children die annually from measles and its complications. Delayed mortality, occurring up to 12 months after infection, causes many additional deaths." (WHO Weekly Epidem Rec 1988; 63:9-13). As with smallpox or polio or any other communicable disease, elimination throughout the world means elimination country by country. Therefore, the success of elimination in Canada will be critical for future programs aiming at elimination in developing countries.

Source: Canada Diseases Weekly Report, Vol. 15 - 1, 1989.

August 1989
Volume XI, Number 4

Seventh Meeting of the Technical Advisory Group on EPI

Introduction

The Seventh Meeting of the Technical Advisory Group on EPI and Polio Eradication (TAG) was held 11-14 July 1989 in Cartagena, Colombia. Approximately 120 persons from 21 countries attended the meeting, including representatives of the Ministries of Health of the governments of the countries of the Region, the agencies funding the effort (USAID, PAHO, Rotary International, UNICEF), WHO, the Japanese Government, and the Task Force for Child Survival. Dr. Donald A. Henderson, president of the TAG, presided over the meeting; Dr. Alan Hinman served as Rapporteur; and Dr. Ciro de Quadros served as Secretary. All members of the TAG were present at the meeting.

Following a summary of the situation of the EPI and polio eradication efforts in the Region and a summary of global progress in the EPI, the meeting turned to a review of progress and problems in each of the countries in the Andean sub-region. Specific presentations were then made regarding the programs in Brazil, Mexico, Central America, Haiti, and the Southern Cone. After this there was discussion of the laboratory situation in the Region, the accomplishments of various "mop-up" programs, the specificity and sensitivity of the case definitions in use, considerations of importations of polio from other Regions, and studies on appropriate formulations of oral poliovirus vaccine (OPY).

Discussion then turned to measles, focusing on progress toward measles elimination in Cuba and the resolution by countries of the English-speaking Caribbean to eliminate indigenous transmission of measles by 1995. There was then consideration of opportunities missed and opportunities gained to provide immunizations, the current situation with neonatal tetanus, the use of the polio eradication program to provide cost estimates for EPI, and on remaining relevant issues for achieving eradication of polio, including polio surveillance in the environment.

The representatives of Ministries of Health of the Andean Region signed a declaration in which they set up a group with the purpose of strengthening the EPI and the Polio Eradication Plan and jointly addressing solutions to common problems. They agreed to hold a meeting in Ecuador during the month of November 1989 to establish short-term joint strategies.

As has been the case at previous meetings, the quantity of information available, the quality of presentations, and the obvious accomplishments of individual programs clearly demonstrated the remarkable progress that has been made in the Americas in implementing the EPI and in getting closer and closer to the target of universal childhood immunization and polio eradication.

Conclusions and Recommendations

1. The adoption by the English-speaking Caribbean countries of a target of elimination of indigenous transmission of measles by 1995 represents an important and ambitious "next step" in improving health through immunization. It must be recognized that the target is an intermediate one (on the road to eradication) and that it will be essential to maintain universal immunization and aggressive surveillance even after its attainment because of the inevitability of importation of measles virus with likely subsequent explosive spread among remaining susceptibles. Even this "intermediate" target presently seems feasible only in locations such as the Caribbean islands where immunization levels are currently high and where insularity lessens the threat of importation. Experience gained during this initiative will be vital to the development of future plans for measles elimination in continental countries within the Region.

   With regard to the measles elimination initiative in the English-speaking Caribbean, several general recommendations can be made as guidance in the development of more specific plans:

   - The strategy proposed of initial mass vaccination or revaccination of all persons 12 months to 15 years old (regardless of previous immunization history) followed by routine vaccination is appropriate.
   - Use of MMR vaccine rather than single antigen measles vaccine will bring additional health benefits to these countries.
   - Experience in the United States and other countries indicates that measles transmission can be sustained even in areas with high immunization coverage among the remaining unvaccinated individuals and the small proportion of primary vaccine failures. Consequently, following the initial mass campaigns, a routine two dose schedule is recommended, with the first dose given at 12-15 months and the second at the time of entry to kindergarten or school.
   - "Certification" of elimination is not recommended because it might convey a false sense of security and there is a continuing risk of introduction and transmission of measles.

2. Increasing experience with measles vaccination programs in the Region (and in other parts of the world) demonstrates that partial coverage of a population with measles vaccine not only protects the individuals vaccinated but also alters the epidemiology of the disease such that epidemic cycles become spread out (e.g., from every two years

to every five years). Until transmission is permanently interrupted, most countries can expect periodic outbreaks of measles. As overall measles incidence will have been substantially decreased, there is the risk that these outbreaks may attract undue attention. It is important to anticipate that these outbreaks will occur and to investigate them to assure that individual protection against measles (vaccine efficacy) remains high. It also must be remembered that, although individual outbreaks may be dramatic, the immunization program does provide significant cumulative reduction in the impact of measles, particularly in the number of deaths.

3. Given the rapid pace of events and the imminence of the target date, TAG proposes to meet again early in the coming year. Particular emphasis will be placed at that meeting on progress in providing laboratory support, monitoring of coverage by county, performance of the negative reporting system, completion and evaluation of "mop-up" operations, results from the environmental monitoring pilot program, further information on the pattern of circulation of wild poliovirus in the Region, further information on possible refinements of the case definition, Regional/ country plans of action for the coming months, and further progress in control of measles and neonatal tetanus.

December 1989
Volume XI, Number 6

Caribbean EPI Meeting

The VI Caribbean Meeting of EPI Managers took place in Barbados, from 13-17 November 1989. The Meeting was opened by the Chief Medical Officer of Barbados in representation of the Minister of Health and was attended by the EPI managers of all the English-speaking Caribbean countries, plus Suriname. Besides the EPI Managers, the Meeting was also attended by epidemiologists, MCH nurses, virologists, statisticians and social communicators.

Representatives of the International Agencies that are collaborating with the countries for the implementation of this program, such as the Pan American Health Organization (PAHO), the Caribbean Epidemiology Center (CAREC), UNICEF, the Canadian Public Health Association (CPHA) and Rotary International also attended the Meeting. For the first time in this series of Caribbean EPI Meetings, one member of the EPI Global Advisory Group (GAG) also attended.

The objectives of the Meeting were:

a) to review the achievements of the various countries in the implementation of their annual work plans that were developed during the V Meeting, held in Grenada in November 1988 and to prepare the annual work plans for 1990;
b) to review the epidemiological situation of measles and polio in the area in general and some countries in particular; and;
c) to review and discuss the Plan of Action for the Elimination of Measles from the English-speaking Caribbean by 1995. This had recently been approved by the Caucus of Ministers of Health of the English-speaking Caribbean and subsequently endorsed by the PAHO Directing Council at its Meeting in September, 1989.

Conclusions and Recommendations

1. Remarkable progress has been made by the English-speaking Caribbean countries towards the achievement of the EPI targets of universal childhood immunization and polio eradication by 1990.

Many countries have achieved immunization coverage in excess of 80% for most of the EPI vaccines and the incidence of the EPI diseases has reached minimal levels. Poliomyelitis due to wild poliovirus has not been detected in any country since 1982. Diphtheria, whooping cough and tetanus have practically disappeared, and measles, the EPI disease that still remains a significant problem, has declined continuously since 1982, despite a slight increase in 1988 compared with 1987 (Figure 1).

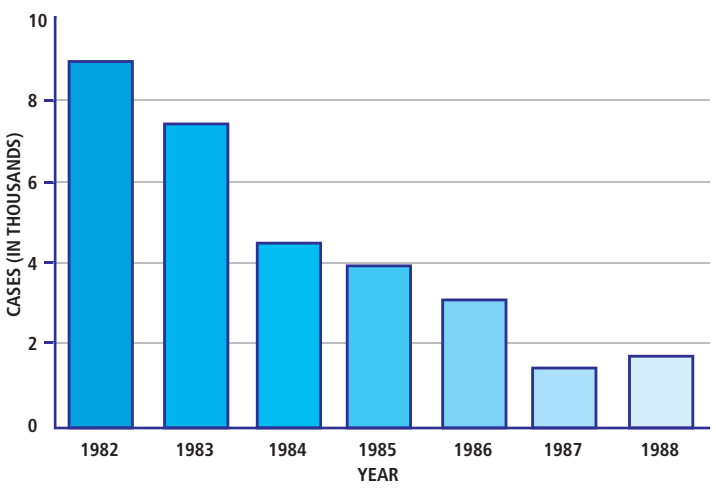
However, much work still remains to be done if these levels of coverage are to be maintained and if the certification of interruption of transmission of polio and the elimination of measles by 1995 are to be achieved.

2. The Group reviewed the Plan of Action for the Elimination of Measles from this area by 1995 and there was consensus that several actions could start even before additional resources become available. These include:

a. Adoption of the standard case definitions outlined in the Plan of Action by all countries. These definitions are:
   - Suspected case: any illness with rash and fever.
   - Probable case: generalized maculopapular rash with more than 2-3 days duration and fever higher than 101°F with coryza, or conjunctivitis, or cough.
   - Confirmed case: fulfills the case definition and has epidemiological linkage with another confirmed or probable case or is laboratory confirmed.
b. A suspected case should be reported immediately by the attending physician and investigated promptly by the epidemiologist, who discards the case if it fails to meet the case criteria for a probable case. If the case meets the criteria for a probable case, control measures will be instituted immediately with vaccination of all contacts irrespective of their previous vaccination status, (the age group for this vaccination will be determined by the characteristic of the outbreak) and investigations to identify the source of infection will follow. Specimens will also be taken for laboratory confirmation at the designated reference laboratories.
c. The present reporting network, which in many countries relies solely on sentinel reporting, should be expanded to include all health facilities and private practitioners. The reporting network should also institute negative reporting, in which zero cases will also be reported.
d. A standard case investigation form should be adopted by all countries. It is suggested that the form that is in the PAHO/WHO Surveillance Guidelines be adopted by all countries, until the PAHO Field Guide for Measles Elimination becomes available in early 1990. This Field Guide will be discussed by the designated country epidemiologists at a Meeting to be organized by PAHO and CAREC in early 1990.

3. The Group agreed that the ideal period to launch the Caribbean "Measles Elimination Month," in which all children under 15 years of age would be immunized against measles irrespective of their previous immunization status will be May, 1991. This also coincides with the celebration of the "Child's Month" in many Caribbean countries.

FIGURE 1 Reported cases of measles in the English-speaking Caribbean, 1982 to 1988.



4. If the plan to eliminate measles is to succeed, very intensive social communication and mobilization will have to be undertaken. This will require the preparation of a Caribbean Social Mobilization Plan, which must address the need to increase awareness of political and community leaders, the population in general, and health workers of the activities to be implemented and the importance of acceptance of vaccination. This will be particularly important in relation to the Caribbean Immunization Month, in which all children under 15 years of age will have to be immunized, many of whom will have been vaccinated or suffered the disease. The Plan will also have to address specific country needs and population attitudes towards immunization. PAHO and UNICEF are requested to initiate actions for the elaboration of this Plan, in collaboration and after consultation with national authorities. A special meeting in which country representatives will prepare their national social mobilization and communication plans should be organized by PAHO and UNICEF in early 1990.

1990

April 1990
Volume X11, Number 2

Eighth TAG Meeting Held in Mexico City

The Eighth Meeting of the PAHO Technical Advisory Group (TAG) for the Expanded Program on Immunization and Polio Eradication took place in Mexico City March 19-22, 1990. Dr. Juan Manuel Sotelo, PAHO Representative in Mexico, welcomed the participants in the name of the PAHO Director and Dr. Jesus Kumate, Minister of Health of Mexico, opened the Meeting.

The considerable advances made by the countries since the meeting in Cartagena held in July, 1989 were noted. Particularly notable is the fact that it has now been more than three years since the last isolation of wild poliovirus in the countries of the Southern Cone, more than two years since the last isolation in Central America, and more than one year since the last isolation of wild poliovirus in Brazil. Also notable is the fact that there has not been a confirmed case of polio from which wild virus was isolated in the Region for more than five months.

In addition, there are important improvements in other program indicators, including significant increases in vaccine coverage in some countries (e.g., Colombia). Most countries are now reporting coverage by "municipio" and are tracking surveillance activities by performance of reporting units. In most countries, interagency coordinating committees have played an important role in strengthening programs. The laboratory network has also been strengthened significantly and advances in molecular biology promise to be an important additional tool in documenting interruption of transmission. The continued support of PAHO/WHO, UNICEF, AID, Rotary International, the Inter-American Development Bank (IDB), and the Canadian Public Health Association (CPHA) has been critical to these advances.

Faced with this mixture of progress and problems, the TAG made the following recommendations:

In recent years, measles vaccine coverage in many countries of the hemisphere has increased and the overall impact has been demonstrated by the decrease in cases reported, changes in the age distribution of cases, and increasing interval between epidemics. Despite the occurrence of epidemics of measles, it should be remembered that in the absence of vaccination, the number of cases expected annually would approximate 95% of the number of births. Nevertheless, the number of cases reported in 1989 in some countries of the Hemisphere was unusually high compared to recent years. This raises questions concerning what the appropriate future strategy for measles control or elimination should be.

The TAG recommends that all countries make efforts to improve coverage for measles vaccine to the highest possible level. Between now and the next meeting of the TAG, studies should be undertaken to develop the information base needed to make recommendations concerning strategies for control of measles outbreaks.

Experience in some countries has shown that where coverage is below 90%, efforts to control outbreaks represent a diversion of scarce resources that could better be used for improving coverage either through mass vaccination days or institutional delivery. However, this issue deserves review and data from current outbreaks should be collected and analyzed. Experience with mathematical models may be useful in developing the strategy.

Further studies of missed opportunities and innovative approaches to reduce these system failures (such as those carried out in El Salvador and Colombia) should be aggressively pursued by all countries.

June 1990
Volume XII, Number 3

Measles Elimination in the English-Speaking Caribbean and Suriname

A technical working group was convened at CAREC May 21 to 23, 1990 to review the PAHO/

To maintain measles elimination in the Americas, countries have implemented high-quality follow-up campaigns every 4 to 5 years, paying special attention to reaching excluded populations in order to provide them with a second measles and rubella vaccination opportunity.

EPI Measles Elimination Field Guide and discuss the status of surveillance for acute flaccid paralysis. The following summarizes selected major points of consensus, and initial operational commitments and requirements.

Review of PAHO Measles Elimination Field Guide

Current surveillance systems must be enhanced. A sensitive system requires reporting of the condition "febrile rash" (suspected measles) and thus facilitates appropriate control measures to eliminate remaining chains of transmission.

A key strategy to interrupt chains of transmission involves a Caribbean Measles Elimination Month, when all children between 1 and 15 years of age should be immunized regardless of previous immunization history. Priority should be given to high-risk children.

This campaign must be complemented by vigorous outbreak control to eliminate remaining foci of infection. More selective campaigns may be needed depending on local circumstances.

Control of measles importation requires further discussion. As private practitioners attend measles cases and, in some countries participate in providing immunizations, timely efforts are needed to sensitize physicians to the importance of this disease, and to enlist their participation in this program, including" the surveillance effort.

In view of the need for a highly sensitive surveillance system, health staff other than epidemiologists must be trained to assess "suspected" cases and to investigate "probable" cases of measles. Functional communication and collaboration should exist among individuals responsible for MCH, EPI, and Epidemiology.

Laws requiring proof of measles immunization, as well as other EPI immunizations, at time of school entry should be strictly enforced where they exist and established where they are lacking.

A detailed draft plan for implementation is being finalized.

Initial Operational Commitments and Requirements

Measles: To the extent possible countries should attempt to start surveillance of "febrile rash" and report on their initial experience at the November EPI Manager's meeting. Epidemiologic data also should be collected on any outbreaks which might occur.

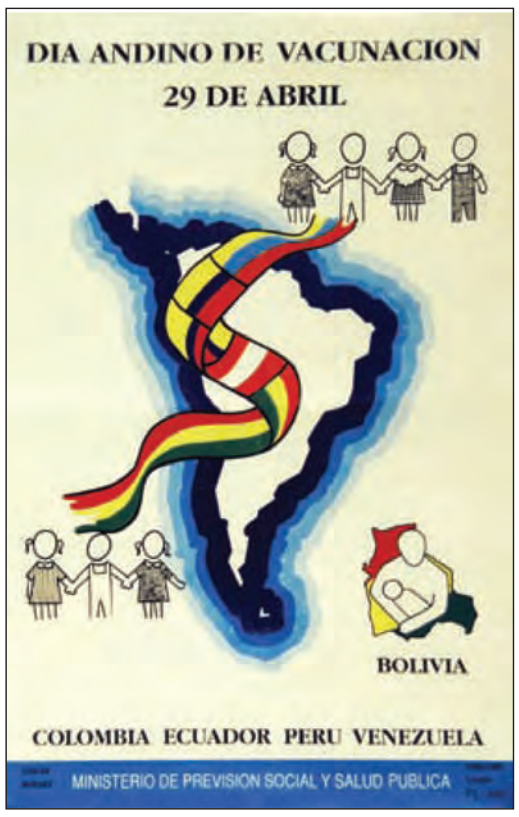
Resource levels (financial, human, equipment, and logistic support) in many countries are not sufficient to support the Regional Plan of Action for Measles Elimination. PAHO therefore should continue discussions with donor agencies with a view to enhancing financial resources as soon as possible.

The need to reaffirm political commitment for the measles elimination effort during the meeting of the English-speaking Caribbean Ministers of Health in July was stressed.

October1990
Volume X11, Number 5

The EPI in the Andean Region

The Second Andean Meeting for the Assessment of EPI and Polio Eradication was held in La Paz, Bolivia, August 27-29, 1990. This meeting followed the decision adopted by the Andean countries during the Seventh Meeting of the EPI Technical Advisory Group in Cartagena (July 1989), to coordinate activities so as to reach the goals of EPI regarding universal child vaccination and polio eradication by 1990. The participants included, in addition to central-level officers from the Epidemiology and Maternal and Child Health areas of the participating countries—Bolivia, Colombia, Ecuador, Peru, and Venezuela—, health officers from the local and operative levels, and representatives of the international agencies already cooperating with the Program (USAID, UNICEF, Rotary Club International, and PAHO/WHO). This Meeting served to update the current country status and the efforts being implemented to enhance country immunization programs.



Conclusions and recommendations

1. EPI's activities are being greatly improved in all countries. This suggests that such process could be accelerated, particularly if all efforts are made to perform analysis at the provincial, municipality and district level within each country, so as to adapt the strategies to the local realities.

2. With respect to measles, the following recommendations were issued: enhanced epidemiological surveillance; improved information quality, reviewing and adequately documenting the outbreaks and control actions in connection thereof. This all would be aimed to gather experiences on which field decisions adapted to the Andean realities can be made. Each country should submit a review of a measles outbreak during the next Andean Group meeting. In the event of an outbreak, actions should be aimed to protect high-fatality groups.

3. The examples shown demonstrated the importance of using the information on missed opportunities to effect actions that enhance the use of every contact between the community and the health services, as evidenced by the success of the intranosocomial vaccinations drives, which should be extended to all health services outside the region on a permanent basis. Each country should submit a report on the impact of its missed opportunity reduction actions.

4. Each National Vaccination Committee must be connected with the local Committees representing civilian, religious, and military institutions, so as to gain the valuable assistance of such institutions.

5. The participating countries pointed to the success of the Andean Vaccination Day experience, and recommended its reiteration, provided that the date be set early enough. The idea was also put forward, to turn it into a Latin American Vaccination Day.

6. The issues of cold chain and quality control of biological materials must be subjects of country reports during the next meeting.

October1990
Volume X11, Number 5

Social Mobilization in the Caribbean

EPI Managers and health education specialists from Antigua, Barbados, Bahamas, Belize, Dominica, Grenada, Guyana, Jamaica, St. Lucia, St. Vincent, and Trinidad and Tobago participated in the first workshop on social mobilization in support of the EPI organized by PAHO and UNICEF. The workshop was designed to provide an overview of the program elements essential for mobilizing primary and secondary audiences. It covered the areas of audience identification, data collection, options for developing communication strategies, and evaluation methodologies to assess the effectiveness of social mobilization activities.

The workshop participants defined the process of social mobilization as broad in scope, encompassing activities related to preparing messages and using multimedia as well as mobilizing audiences responsible for organizing or providing immunization services. It was also noted that identifying primary and secondary audiences is crucial in order to ensure that all efforts are made by the national EPI to vaccinate 100% of the target population, and to eliminate the indigenous transmission of measles.

Each country presented an overview of its health education activities, including management and planning efforts designed to support accelerated immunization actions. In spite of sometimes having little input from external sources and minimal budgets, many countries have produced posters, pamphlets, bumper stickers, booklets, and jingles for EPI educational activities. These activities combined with other immunization activities have resulted in EPI vaccine coverage rates ranging between 59-100% for measles MMR vaccine and 71-100% for DPT and OPV vaccines. Thirteen countries and territories have reached 80% or better coverage with measles or MMR vaccine. It was noted that lower vaccine coverage is found in countries with larger populations. The participants concluded that countries have been very successful in their promotional efforts of immunization since EPI vaccination coverage is, on the average, very high. However, it was clearly noted that in many countries coverage had leveled off in the past few years, and that well-organized social mobilization efforts would be needed to reach the remaining 20-30% of the target population. Due to the presence of pockets of severe economic depression and the loss of manpower from the health sector, this population does not currently benefit from immunization services, and is likely to be difficult to reach. More importantly, if measles is to be eliminated from the sub-region by 1995, then social mobilization efforts must be aimed at low coverage/high risk areas where chains of transmission of the measles virus can occur and be sustained.

There was agreement that the goals and activities set to achieve measles elimination by 1995 will be difficult to achieve due to the economic situation and the region-wide exodus of health workers, especially nurses. The resulting shortage means that every sector of society will need to be mobilized to provide support for immunization activities. In addition, it was agreed that national health budgets for preventive health programs such as the EPI need to be increased and maintained to ensure that all available resources are provided to protect children and eliminate the transmission of indigenous measles by the end of 1995.

One concentrated effort towards this goal is the "Measles Elimination Month," which has been scheduled for May 1991. If it is to be successful and if it is to lead to the detection of additional cases of measles afterwards, then it is critical that social mobilization activities be designed to encourage concern in both the public and health sectors for maintaining high levels of measles immunization coverage and reporting suspected measles cases. This last point cannot be overemphasized since the success of eliminating the transmission of measles also hinges on adequate surveillance of rash and fever cases. Every country and territory will have to define coverage problems and ensure reporting by the community and health sectors. Once completed, appropriate goals can be set and strategies and communication activities can be proposed to reach the goal of 100% vaccination coverage with all EPI antigens, particularly measles vaccine.

Recommendations

1. All countries and territories should prepare social mobilization programs as part of their national EPI Plan of Action, using the "social mobilization matrix" if possible.
2. PAHO should create a task force to follow up with every country and territory on the development of social mobilization programs and assure the implementation of activities in accordance with the Guidelines for the Implementation of Measles Immunization Month in the English-speaking Caribbean and Suriname.
3. All national and political authorities as well as influential community leaders should be contacted as early as possible to inform them of the goals regarding the EPI. Their vigorous support in mobilizing all sectors of society could prove invaluable.
4. A Caribbean-wide program to organize the participation of target populations should be established as a feature of the social mobilization effort towards measles elimination.

December 1990
Volume X11, Number 6

Progress in Central America

Introduction

The Sixth Central American Meeting for the review of EPI and polio eradication was held in San José, Costa Rica, from 7 to 9 November, 1990. This meeting was attended by representatives of Belize, Costa Rica, El Salvador, Guatemala, Nicaragua, Honduras, Panama, Mexico, and INCAP, the Reference Laboratory for polio diagnosis in the Subregion, as well as by neuropediatricians that are cooperating with the program in the various countries.

The meeting was also attended by epidemiologists, virologists,

maternal and child specialists, and supervisors of the central, regional, and operative levels of the participating countries. Present, in addition were representatives of the international agencies cooperating with the program (USAID, UNICEF, Rotary International, and PAHO/WHO).

Vaccination Coverage

Only four of the eight countries invited—Guatemala, Honduras, El Salvador, and Nicaragua—submitted coverage data by county or health area updated to the second semester of 1990 for OPV3 under 1 year of age.

Measles Control

The measles epidemics which have been occurring in the Subregion since 1988 have persisted in Guatemala and Mexico up to the first semester of this year. Presently, only Nicaragua shows epidemic levels, while in Panama outbreaks began appearing in September.

From the reports presented, it is apparent that coverage remains low, leading to a persistent risk of new epidemics due to the permanent accumulation of new susceptibles.

So as to achieve appropriate control of measles, the following is recommended:

- Intensify epidemiological surveillance of measles, along with coverage surveillance by county, thus ensuring a minimum coverage of 90% for children under age 5.
- Promote field research, documentation, and present results at upcoming meetings.
- Maintain the current vaccination schedules with a single dose of measles vaccine.

December 1990
Volume X11, Number 6

Progress in the Southern Cone

Introduction

The Sixth Meeting of the "Asunción Group" on EPI progress and Eradication of Polio in the Southern Cone, Bolivia, and Brazil was held in Asunción, Paraguay, from 29-31 October, 1990. This group first met in Asunción in July, 1987, and has held periodic meetings for follow-up of activities and to discuss the actions needed to accelerate the achievement of EPI's goals of universal child immunization and eradication of polio by 1990.

The meeting was attended by professionals from the ministries of health of the countries mentioned above and by representatives of the international organizations supporting these efforts, namely Rotary International, UNICEF, USAID, and the Pan American Health Organization (PAHO).

Vaccination Coverage

With the exception of Argentina, all countries submitted preliminary coverage data up to June, 1990, which appear to be similar to the 1989 data; in Paraguay and Bolivia, however, low coverage requires prompt intervention. This suggests that further and more active efforts are needed if the goals of universal vaccination and polio eradication by 1990 are to be achieved.

It is noteworthy that all countries (some of them for the first time) submitted coverage analysis by county, a significant accomplishment for the program.

- All countries should update the vaccination coverage information system monthly, by municipality. These updates should be done at the central level of the health ministry. National coverage data for 1990 should be submitted to PAHO in February, 1991.
- Coverage information by municipality should be shared with the relevant political authorities in order to facilitate improvement-oriented decision making in this area.
- Neighboring countries should be informed when there are outbreaks of vaccine-preventable disease which require joint actions, or if there is a risk of export or import of the disease.

Measles Control

Countries showed different epidemiological situations; some of them have high vaccination coverage levels for many years; others still have low coverage.

- Each country should identify low coverage "pockets" so as to increase coverage in those risk areas.
- Epidemiological surveillance should be adapted to the needs of each country. Each country should choose between weekly or monthly reports from the reporting units, or select a system consistent with its control capabilities. As much as possible, such systems should be integrated into the polio surveillance system.
- A uniform operational definition should be used for measles cases; i.e., all cases where high fever for more than three days is present, along with rash, coryza, coughing and conjunctivitis.
- Measles control and surveillance actions will vary according to each country's program development. In those cases where the program is developed and coverage rates are high, each suspected case must be investigated. In those countries where coverage rates are still low, only measles outbreaks should be investigated. Those countries still exhibiting low coverage should concentrate their efforts on increasing them as soon as possible.
- The program's response to outbreaks must be oriented to assessing the epidemiological situation and to implementing vaccination programs in those areas still unaffected.

Conclusions and Recommendations

1. Each country's epidemiological surveillance system should be reviewed in order to introduce all remedial actions permitting the certification of the eradication of the wild poliovirus and timely follow-up of measles outbreaks.
2. All the ministries of health should prepare EPI Plans of Action for 1991, as well as five-year plans.
3. Each country should try to devise mechanisms that ensure that syringe and vaccine purchases are made with local funds, thus avoiding dependence on external sources for their procurement.

December 1990
Volume XII, Number 6

Measles Elimination in the Caribbean

Introduction

The VII Caribbean Meeting of EPI Managers took place in Antigua, from 12-15 November 1990. It was opened by the Minister of Health of Antigua and Barbuda and was attended by the program managers of all the English-speaking Caribbean countries, Suriname, as well as Aruba, Curaçao, Guadalupe, and Martinique.

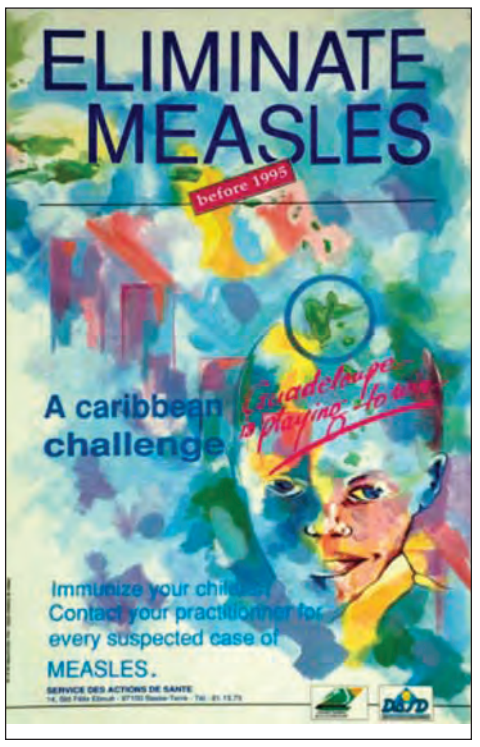
The PAHO Caribbean Program Coordinator and the Director of the Caribbean Epidemiology Center (CAREC) were in attendance at the opening session.

Representatives of international agencies that support the program included the USAID, UNICEF, CPHA, Rotary International, and the Pan American Health Organization. The Rapporteur of the EPI Global Advisory Group was also present at the Meeting.

The main purpose of the Meeting was to review the implementation of the immunization programs in each country and identify those problems that are hampering the further improvement of immunization coverage and disease surveillance, which could be addressed by better planning, management and evaluation procedures. The objectives of the Meeting included the review of activities implemented during 1990 and the preparation of the workplans for 1991. This year, these workplans included activities relating to the elimination of measles by 1995, especially the preparation of the Caribbean Measles Elimination Month, being planned for May, 1991 and further activities related to the need for heightened surveillance of rash illnesses and flaccid paralysis. These last activities are essential for the eventual certification of interruption of indigenous transmission of wild poliovirus and elimination of measles from the English-speaking Caribbean.

Conclusions and Recommendations

1. Significant progress has been achieved in the majority of countries with regard to sustaining or increasing immunization coverage in the target age groups. Some countries have experienced a decrease in immunization coverage and efforts should be made to correct this situation.
2. Some progress has been made in the establishment of the groundwork needed for surveillance of flaccid paralyses and rash illnesses. The rate of notification of flaccid paralysis for the Caribbean is increasing, but it is still low compared with other subregions of the Americas. It will be necessary to speed up the establishment of a system for negative reporting and also collection of stool specimens from every case of flaccid paralysis and its contacts, as prerequisites for the certification process.
3. The draft Field Guide for Measles Elimination was reviewed and comments received from participants. It is expected that this Field Guide will be finalized at the Meeting of Epidemiologists to be held at CAREC in Trinidad from January 14-18, 1991.
4. It will be necessary for PAHO and CAREC to provide permanent monitoring and support to countries as far as surveillance is concerned. This must include laboratory support and training of country epidemiologists.
5. Some of the problems that still hamper further improvement of vaccination coverage and disease surveillance include:
   - On occasion, delays in payment for vaccines ordered through the EPI Revolving Fund impede the receipt of new shipments;
   - Stand-by generators still are required at all central stores, and gas and kerosene refrigerators are still in short supply for those areas without electricity;
   - Training for surveillance of EPI diseases, particularly measles and poliomyelitis needs to be implemented;
   - Promotional materials, such as audiovisuals, posters, and flyers are in greater demand and additional resources are needed to address this issue;
   - Due to personnel and financial constraints, supervisory visits to health centers have been affected;
   - Data collection from private practitioners is still a bottleneck for determining immunization coverage in many countries;
   - National Plans of Action arc not systematically followed up to ensure that all planned activities are implemented.
6. As far as the Measles Elimination initiative is concerned, there are issues that need to be addressed and resolved before the January 14th meeting, including:
   - The key strategy for interrupting measles transmission in all countries is the elimination of all susceptibles under 15 years of age, simultaneously. Therefore, every country will have to ensure that any deviation from this strategy will still achieve interruption of transmission.
   - Financial resources, particularly for vaccine purchase, have not yet been fully identified in most countries. It is noted that while measles can be eliminated with the use of measles vaccine alone, this would represent a considerable missed opportunity for control of rubella and mumps. The Group urges that every effort be made by the Ministries of Health, with the support of PAHO and other collaborating agencies, to ensure the availability of MMR vaccine for this initiative.
   - There were concerns over the social communication and mobilization plans. Considering the available time between now and the proposed "Measles elimination Month" in May, 1991, it is imperative that an overall communication and mobilization plan be organized for immediate implementation.
7. The exchange visits of EPI Managers were reviewed and it was recommended that they continue, as they are invaluable for managers to share experiences and learn from each other.
8. The VIII Caribbean Meeting of EPI Managers should be held in November, 1991.



1991

February 1991
Volume XIII, Number 1

EPI Global Advisory Group Report

The EPI Global Advisory Group met from 14-18 October, 1990 in Cairo, Egypt. A summary of the conclusions and recommendations follows.

Overall Program Status:

Immunization programs in developing countries have made remarkable progress since the inception of the Expanded Program on Immunization (EPI) in 1974 when it was estimated that less than 5% of the world's infants were adequately immunized. Today, some 70% are being reached with a protective course of immunization by the first year of life. The development of the capacity to achieve these levels of coverage of infants represents a major public health triumph for the end of the decade of the 1980s.

Achieving and Sustaining Full Immunization Coverage:

High immunization coverage levels need to be achieved and sustained. Intensified immunization activities, including the use of national or local immunization days, should be directed at areas of low immunization coverage or where there is continuing transmission of disease.
Each country should have an Immunization Plan of Action which integrates the targets of achieving at least 90% immunization coverage with all EPI antigens, poliomyelitis eradication, neonatal tetanus elimination and measles reduction, and, in areas of risk, delivery of appropriate micronutrient supplementation.

The following areas are priorities for achieving and sustaining immunization programs: donor coordination, donor support, management supervision and training, communications, and costing and budgeting.

Measles Reduction:

Increasing immunization coverage along with improving disease surveillance are the two key elements to control measles and will achieve, by 1995, reduction by 95% in measles deaths and 90% in measles cases compared to pre-immunization levels. In localities with high population densities, very high coverage rates will be needed to achieve this target. Outbreaks must be expected even in programs with relatively high coverage, and they should be analyzed to ensure that there is high vaccine efficacy and that immunization schedules and delivery strategies are epidemiologically appropriate.

To meet the 95% mortality reduction target and to reduce morbidity associated with acute attacks of measles, treatment guidelines should be developed. As a priority, vitamin A should be administered in large doses to children with measles in high-risk areas following the joint WHO/UNICEF guidelines to reduce post-measles deaths and complications (including blindness).

April 1991
Volume XIII, Number 2

Technical Advisory Group Meets in Guatemala

Introduction

The Ninth Meeting of the PAHO Technical Advisory Group (TAG) on Vaccine-Preventable Diseases took place in Guatemala City, Guatemala, from 12 to 16 March, 1991. Participants were welcomed by Dr. Antonio Casas, PAHO Representative in Guatemala, on behalf of Dr. Carlyle Guerra de Macedo, the PAHO Director. The Meeting was officially opened by the President of Guatemala, Ing. Jorge Serrano Elias, who emphasized that prevention is the most cost effective intervention available to policy makers in the area of health. The TAG members present were Drs. Hilda Alcalá, D.A. Henderson (Chairman) and Joao Baptista Risi, Jr. Unable to attend were Drs. José Manuel Borgoño, Peter Figueroa, and Alan Hinman (Rapporteur). Dr. Frederick Robbins, the Chairman of the Poliomyelitis Eradication International Certification Commission for the Americas established by the PAHO Director in July, 1990, also attended the Meeting. Representatives of the USAID, UNICEF, IDB, and Rotary International, agencies that are collaborating with the countries in this priority program, were also present at the meeting.

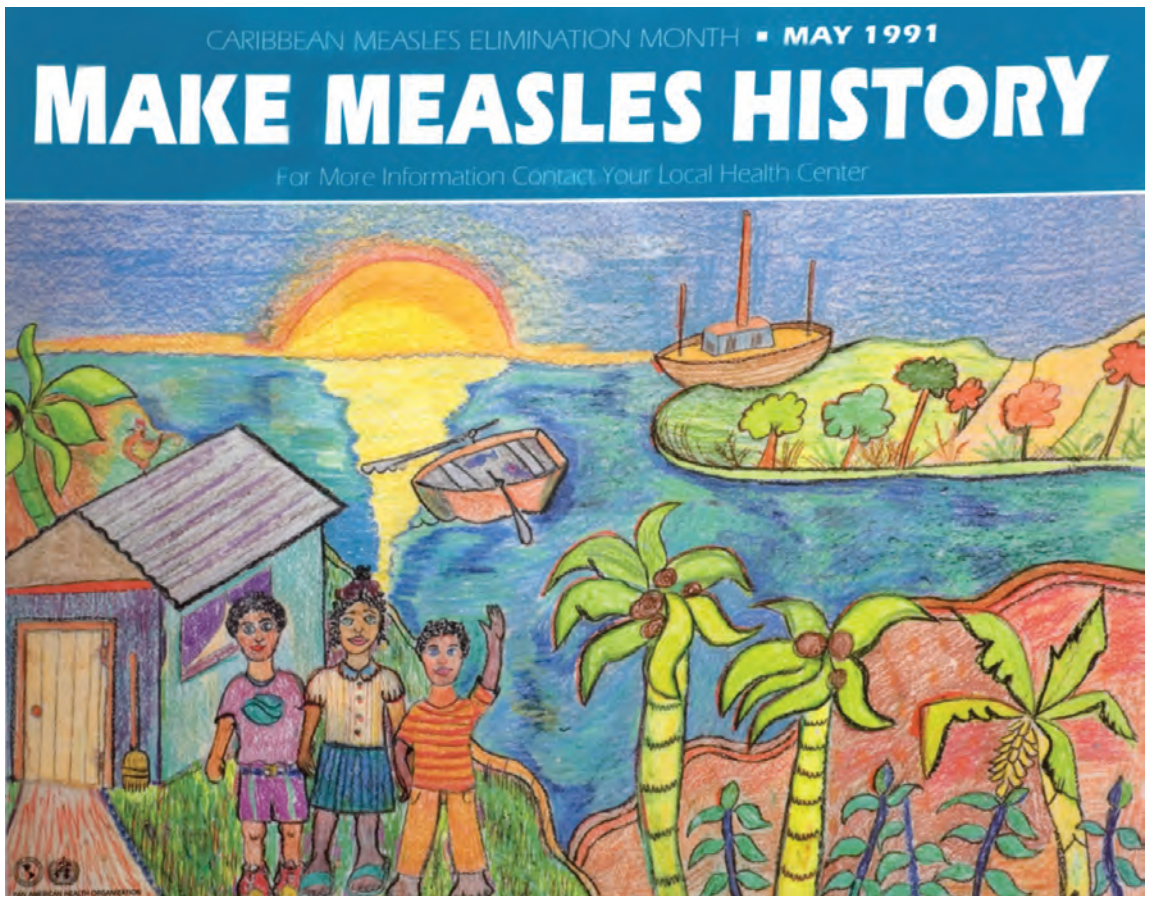
The World Health Organization was represented by personnel from its Headquarters in Geneva and from the Regional Offices of the European and Eastern Mediterranean Region. Representatives from Egypt, England and France were also in attendance. Dr. D. A Henderson chaired the Meeting; Dr. Joao Baptista Risi, Jr. was the Rapporteur (ad-hoc); and, Dr. Ciro de Quadros served as Secretary.

Specific Recommendations: Measles Control

In spite of increased overall vaccination coverage, measles outbreaks have continued to occur throughout the Region. This is due to the fact that except for Cuba, even those countries with the highest immunization coverage have not achieved levels that would ensure the elimination of transmission.

Efforts carried out in Cuba and the measles elimination initiative in the English-speaking Caribbean will permit the development of effective strategies aimed at controlling/eliminating the disease.

The low coverage rates that exist among priority groups



continue to be the greatest impediments to the control of measles and efforts at increasing coverage among children under two years of age should be undertaken.

June 1991
Volume XIII, Number 3

Make Measles History

In 1988, the Caucus of CARICOM Ministers Responsible for Health made the commitment to "make measles history," when they unanimously resolved to eliminate the indigenous transmission of measles in the Caribbean by 1995, as one of the priority projects within the Caribbean Cooperation in Health Initiative. The Ministers recognized that the Caribbean could become the first region in the world to achieve measles elimination.

The Pan American Health Organization was asked to develop a Plan of Action to achieve this target. As this drive gets underway, national efforts are being reinforced with support from PAHO in conjunction with the Canadian Public Health Association, UNICEF, Rotary International, the Academy for Educational Development, AID, the Caribbean Broadcasting Union, the Caribbean News Agency, and others.

The "Make Measles History" campaign, had as its primary strategy for interrupting measles transmission, the simultaneous immunization of all susceptible persons. To that end, May 1991 was declared "Measles Elimination Month" and a full-scale attempt to simultaneously immunize all susceptible persons under 15 years of age—regardless of previous vaccination status or history of measles—was launched.

To ensure the success of the Measles Elimination Month, full participation from the community was needed. A large social mobilization effort was undertaken to inform everyone that they must vaccinate all children. This regional effort included a series of television and radio public service announcements, Information Kits with brochures, fact sheets, and posters, buttons, and a half-hour television special, "Make Measles History," designed to entertain and inform. In general, the countries were very receptive toward the campaign and very pleased with the quality of products.

April 28th was chosen as the day to officially inaugurate the campaign, since it coincided with the International Children's Day and would lead right into Measles Elimination Month. In most countries, the television special was aired on the target date during prime time. Many countries even aired the special two and three times. The television special was hosted by a popular comedian and storyteller and featured the talent of contemporary calypso, reggae, and rap musicians. The fact that these stars have lent their talent to a worthy cause helped build credibility for the measles campaign.

The success of Measles Elimination Month also depended on the coordination of health agencies with community members. To this end, Health Ministries participated in the publicity and encouraged parents to be sure to have their children vaccinated. Health workers visited schools to make sure all the students knew they must be vaccinated. Teachers reinforced the message by reminding students and through such creative measures as holding contests to see which class achieved full immunization first. Health authorities set up multiple vaccination posts and clinics throughout the islands, with a variety of posts operating on different days and at different hours, to make immunization as accessible as possible. A huge logistics effort was undertaken to ensure that each clinic had all the vaccines and syringes necessary and that the "Cold Chain" was maintained.

Measles Elimination Month was a success and the campaign is off to a great start. Between now and 1995, the crucial steps necessary for the ultimate success of the effort are continued high levels of immunization coverage (90% or greater) and enhanced surveillance coupled with an aggressive response to any measles outbreak.

August 1991
Volume XIII, Number 4

Progress Achieved in Measles Elimination Campaign

As a result of the highly publicized measles elimination campaign, 91% of the target population in the English-speaking Caribbean (see *EPI Newsletter,* Vol. XIII, No.3, June 1991) was immunized with measles vaccine this May (Table 1). This event, which represents the largest coordinated health effort ever attempted in the Caribbean, initiated a five-year campaign by the Pan American Health Organization and other donor agencies (CIDA/CPHA, UNICEF, Rotary International, and USAID) to vaccinate the entire population under age 15 and eliminate the indigenous transmission of measles. To this end, countries of the English-speaking Caribbean and Suriname mobilized all their manpower and material resources and simultaneously achieved the highest immunization coverage against measles ever recorded in the area.

Member countries held meetings this July in Trinidad and Tobago, Antigua, and Jamaica to discuss the Measles Elimination Field Guide and the rapid implementation of the measles surveillance system. All member countries agreed that a single suspected case of measles should constitute a public health emergency and they adopted specific procedures for prompt reporting, investigation and control.

Everyone agreed that strategies are needed to find and immunize those children not vaccinated this May and to vaccinate children born

each succeeding year. These measures are needed to limit the size of the susceptible population and reduce the possibility for an explosive outbreak of measles.

Measles Activity

The CAREC surveillance system indicates cumulative totals of the reported measles cases through the month of April at 3,264 in 1990 and at 102 in 1991. The numbers of reported cases decreased by a factor of 20. The continued activity in Trinidad and Tobago and in Jamaica may represent the tail-end of last year's epidemic. Laboratory analysis performed at the CAREC Laboratory from the sera of cases of fever and rash illness in 1991, has confirmed measles activity only in Trinidad.

The coverage achieved during Measles Elimination Month (91%) is well approaching the goal of 95%. High coverage is important because it will sharply reduce the incidence of measles cases and enable the surveillance activities to concentrate on the remaining cases to be investigated and contained.

Several factors suggest that measles will occur at low levels in the CAREC-member countries for the next few years. The epidemics of 1989-1990 had the two-fold effect of eliminating a large number of susceptible children, and increasing vaccination coverage as hundreds of thousands of doses above the routine program were administered in massive campaigns. Furthermore, the Measles Immunization Month of May 1991 put an additional "blanket" on transmission and follow-up efforts will further interrupt transmission.

The slow build-up of susceptible populations from future birth cohorts will be a critical factor beyond the next few years. Even if 95% vaccination of the target group is achieved, current measles vaccines are 95% efficacious, so approximately 10% of each year's birth cohorts will remain susceptible. These cohorts will accumulate into tens of thousands of susceptible children in a few years. Susceptible populations may also increase due to an influx of children from countries with lower coverage rates.

Some Considerations for the Elimination Campaign

Four main considerations can be drawn for successfully eliminating measles and maintaining a "measles-free zone." First, the target vaccination coverage for children should be 100% by the time they reach their second birthday. Second, programs attempting to improve efficacy by changing the vaccination schedule from nine to 12 months should do so only if incidence is very low. Third, the temptation may exist to prematurely declare measles eliminated in a few years if indigenous transmission reaches zero as predicted. Immunization against measles can only cease if and when global eradication has been achieved. Fourth, neighboring countries in the Caribbean should be invited to participate in this measles elimination effort and preliminary motions have already been made in this regard. In 1991 epidemiologists from Haiti, the Dominican Republic and Puerto Rico expressed interest in participating.

If indigenous transmission ceases after 1991, it can only resume if the virus is re-introduced into susceptible populations. Because large numbers of people travel

between the Caribbean and the rest of the world, plans are needed to advise travelers going to and from a "measles free zone" and for coordinating information on the occurrence of measles at the global level. Surveillance to identify new foci of transmission and prompt containment will also be necessary.

Specific measures adopted this July by countries participating in the campaign include a detailed reporting system and an aggressive follow-up for suspected cases of measles.

This fall countries began reporting weekly to CAREC all suspected, confirmed, or discarded cases with an I.D. number. When a suspected case is reported, the unit responsible for tracking and surveillance will investigate each suspected case and collect and ship blood specimens.

The surveillance system in each country will attempt to promptly report, investigate and classify all cases of rash and fever illness meeting the definition of a suspected case in the Measles Elimination Field Guide. Any suspected case reported will be the basis for initiating action.

In addition, the surveillance system will be designed to detect sporadic measles cases wherever they occur and follow up with prompt containment actions, including laboratory support and immunization of contacts. In this way, it is planned to eliminate measles by 1995.

Source: CAREC Surveillance Report, Vol. 17, No.4, April 1991; Surveillance and Field Operations Unit and EPI Programme, CAREC.

TABLE 1. Measles vaccination coverage achieved during the campaign conducted in the countries of the English-speaking Caribbean during the month of May, 1991.

Countries (in order of population size at mid-year 1990)	Estimated target population			Total population vaccinated			Percent of target population immunized		
	<2 years	2–14 years	<15 years	<2 years	2–14 years	<15 years	<2 years	2–14 years	<15 years
Anguilla	–	–	2,387	–	–	2 356	–	–	98.7
Turks and Caicos Islands	372	2,988	3,360	213	2,513	2,726	57.2	84.1	81.1
British Virgin Islands**	–	–	–	–	–	–	–	–	88.5
Montserrat	–	–	2,185	–	–	2,184	–	–	99.9
Caiman Islands*	–	–	3,792	–	–	3,218	–	–	84.8
Saint Kitts and Nevis	1,035	12,844	13,879	1,016	12,525	13,541	98.2	97.5	97.6
Dominica	–	–	26,826	–	–	25,512	–	–	95.0
Antigua and Barbuda	317	14,520	14,837	311	13 941	14,252	98.1	96.0	96.1
St. Vincent and the Grenadines	2,615	35,521	38,136	2,503	34609	37,112	95.7	97.4	97.3
Grenada	5,300	31,800	37,000	5,205	31005	36,209	98.2	97.5	97.5
Saint Lucia	2,005	40,300	42,305	2,000	38834	40,834	99.8	96.4	96.5
Belize	–	–	77,975	–	–	64,246	–	–	82.4
Bahamas	2,665	65,801	68,466	2,656	57175	59,831	99.4	86.9	87.4
Barbados	4,155	51,824	55,979	3,760	49815	53,565	90.5	96.1	95.7
Suriname***	–	–	–	–	–	–	–	–	–
Guyana	19,015	214,294	233,309	16,597	201,517	218,114	87.3	94.0	93.5
Trinidad and Tobago	45,410	317,870	363,280	40,869	286,083	326,952	90.0	90.0	90.0
Jamaica	–	–	–	–	–	–	–	–	70.6

Note: Average coverage attained is 91.4%.
* The four to 14 year age group was target population.
** Campaigns took the form of mop-ups.
*** Campaign to be completed at a later date.
Source: EPI Programme, CAREC.

October 1991
Volume XIII, Number 5

Measles Surveillance

Following the huge public health success achieved by the countries of the English-speaking Caribbean and Suriname in vaccinating children between nine months and 14 years of age against measles during May 1991, the time has come to turn efforts towards the strengthening of the measles surveillance systems (see *EPI Newsletter,* Vol. XIII, No.4, August 1991).

PAHO convened meetings to discuss operational issues, criteria and mechanisms for the establishment of a rash and fever illness surveillance system. The countries agreed to begin reporting weekly, on or before September 1, 1991, the occurrence or non-occurrence (negative reporting) of any suspected measles case to CAREC. It was established that any single suspected case of measles should constitute a public health emergency requiring investigation and the implementation of control measures; in addition, health care workers and the general public should continue to be educated and motivated to report these cases.

As agreed, all countries have been reporting to CAREC every Wednesday, for the previous epidemiological week. In addition to the occurrence or non-occurrence of suspected measles cases during that week, each report includes the cumulative number of cases under investigation and confirmed since the onset of the reporting system (September 1), and the number of sites expected to report and the sites which have reported for the week in question.

With the reports received, CAREC compiles a weekly Measles Surveillance Bulletin which is distributed to all countries in the subregion by Friday of the same week and provides feedback on the status of surveillance and progress towards elimination.

On the following page is a sample of the *Bulletin* for the week ending October 26, 1991, which clearly demonstrates the extent of the impact that the Measles Elimination Month had on the incidence of measles in the countries of the English-speaking Caribbean and Suriname.

October 1991
Volume XIII, Number 5

Progress in Central America and the Andean Region

From the 9th to the 11th of September in Managua, Nicaragua and from the 7th to the 9th of October in Caracas, Venezuela, the 7th Central American Meeting and the 3rd Meeting of Andean Countries were held to evaluate the activities of the EPI, the eradication of polio, and the elimination of measles. Haiti and the Dominican Republic participated for the first time in the Central American Meeting, while Mexico joined in as a bordering country. Brazil participated in the Andean Meeting. Following is a summary

Expanded Program on Immunization weekly measles surveillance for the English-speaking Caribbean and Suriname. Measles Surveillance Bulletin, PAHO/WHO.

Vol. 1, No 7. Week ending 26 October, 1991.

Country	Suspected cases reported			Reporting sites		Cumulative cases			
	wk. 41	wk. 42	wk. 43	Expected sites	% Reported in wk. 43	Total	Under investigation	Discarded	Confirmed
Anguilla	2		0	6	100	2	2	0	0
Antigua	0	1	0	8	100	1	1	0	0
Bahamas	1	n/r	n/r	10	–	2	0	2	0
Barbados	n/r	n/r	n/r	8	–	0	0	0	0
Belize	0	4	1	6	100	5	5	0	0
Bermuda	n/r	n/r	n/r	–	–	–	–	–	–
Dominica	n/r	n/r	n/r	–	–	–	–	–	–
Grenada	2	0	0	42	40	2	1	1	0
Guyana	5	2	1	71	94	22	5	17	0
Cayman Is.	0	0	0	10	100	0	0	0	0
Turks and Caicos	0	0	0	8	100	0	0	0	0
British Virgin Islands	0	0	0	10	100	0	0	0	0
Jamaica	2	0	–	43	–	291	11	0	280*
Montserrat	0	0	0	18	100	0	0	0	0
St. Kitts and Nevis	0	0	0	21	100	0	0	0	0
St. Vincent	1	0	n/r	37	–	1	0	1	0
St. Lucía	n/r	2	6	4	100	8	8	0	0
Suriname	0	0	n/r	31	–	5	4	1	0
Trinidad and Tobago	1	2	4	19	100	19	15	2	2
TOTAL CAREC	14	11	12	352	–	358	52	24	282

– No data available.
n/r No report.
* 280 cases confirmed by MOH, Jamaica, prior to September 1991.
X Second case reported from Trinidad was confirmed because of loss to follow-up.
Y Case from St. Vincent discarded as vaccine reaction by MOH.
Z Case for week 41 St. Kitts was discarded by Ministry (CMO).

of the principal conclusions and recommendations reached at each of the meetings.

Vaccination Coverage

All of the countries presented projected vaccination coverage for children less than one year old for 1991. Excluding Ecuador, the Andean Countries and Brazil surpassed coverage levels reached in 1990. In Central America and Mexico, where in 1990 the highest levels in history were achieved, coverage figures appear to be decreasing so far in 1991, partly due to a temporary reduction in the supply of biologicals. This poignantly illustrates the importance of having the governments ensure that the necessary financial resources are available in the national budgets.

With the exception of Costa Rica and Haiti, all countries presented coverage data by county (Mexico presented data by"jurisdicción"). Over 50% still show coverage below 80%, implying that an important proportion of children still live in high-risk areas. In order to increase coverage, Bolivia has instituted a prize that will have the director of the county or district with the highest coverage invited to participate in international conferences.

Measles Control

The increase in coverage with measles vaccine has produced a dramatic decrease in the incidence of the disease. Because a high proportion of the counties still have coverage below 80%, epidemics are still observed at four-year intervals. The data presented at meetings such as these has improved greatly, showing that the most affected age group is that of children under 5 years of age and that the vaccine being used is efficacious.

The plans to eliminate measles from Mexico by 1995 and Brazil by March 1992 were presented. The countries are urged to increase efforts to reach and maintain coverage above 90%, especially in those countries that presently have low coverage. Control of this disease will eventually require a joint continental effort and the experiences of the countries of the English-speaking Caribbean, Cuba, and Brazil will help to illustrate the strategies which will need to be followed.

December 1991
Volume XIII, Number 6

Measles Elimination in Central America

The Council of Ministers of Health of the Central American Countries met with the Country Representatives of the Pan American Health Organization (PAHO), the United Nations Children's Fund (UNICEF), and the United Nations' Development Fund (UNDP) in Roatan, Honduras, from October 31 to November 2, 1991. During this meeting, the Council resolved to ratify and make official for the Central American Region, the decision made by the Ministers of Health of the Region of the Americas at the XXXV Meeting of the PAHO Directing Council to eliminate the indigenous transmission of measles by 1997.

The EPI was launched in Central America in 1977, and from that date the subregion has experienced a considerable increase in vaccination coverage which has been accompanied by important decreases in the incidence of vaccine-preventable diseases. Taking the epidemiology of measles in the area into consideration, the Ministers decided that elimination was feasible and necessary and that it should be initiated in 1992. To this end, they made the commitment to develop National Plans of Action as soon as possible in order to identify the internal and external resources that would be necessary to achieve the goal. They also agreed to strengthen the EPI Interagency Coordinating Committee (ICC) and request that international agencies continue cooperating by making available those additional funds which will be necessary for the countries to carry out this new commitment.

Finally, they requested that the Presidents of the Central American countries commit to measles elimination by 1997 and effectively support the implementation of the National Plans of Action within an integrated regional strategy.

December 1991
Volume XIII, Number 6

Eighth Meeting of Caribbean EPI Managers

The Eighth Meeting of Caribbean EPI Managers was held in Montego Bay from 11-15 November, 1991. It was attended by 90 participants from 18 countries of the English-speaking Caribbean, plus Curaçao, St. Marteens, the French Antilles and Suriname, technical and administrative personnel from the Pan American Health Organization (PAHO) and its Caribbean Epidemiology Center (CAREC), and representatives of the major agencies that are supporting the program in this Region, such as the United States Agency for International Development (USAID), the United Nations International Children's Fund (UNICEF), Rotary Foundation, Rotary in Canada, and the Canadian Public Health Association (CPHA). A number of non-governmental organizations (NGO's) were also present, as were, for the first time, representatives of the Commonwealth Secretariat, and the Italian and French Cooperation in Health.

The three main objectives of the meeting were to review the progress of EPI in the countries of the English-speaking Caribbean, to have them prepare National Work Plans for 1992, to explore all venues for further collaboration between the Ministries of Health and the NGO's to strengthen EPI, and to ensure achievement of the goals of measles elimination and polio eradication.

This was the first time that the various donor agencies and the NGO's were able to discuss with the EPI Managers, the ways in which they can cooperate with the program in their respective countries. This collaboration of public and private sectors is considered essential for the full realization of the goals of the program and resulted from the joint initiative of the Commonwealth Secretariat, CPHA and PAHO.

Following is a summary of the major conclusions and recommendations which resulted:

Immunization Coverage

Immunization coverage rates for all EPI antigens amongst the 19 countries of the English-speaking Caribbean and Suriname were either maintained or improved in 1990.

For the coming years, countries should be classified according to levels of coverage between 50-79%, between 80-90% and above 90%. Pockets of unvaccinated children should now be identified for special mop-up operations and activities to prevent the build-up of large numbers of susceptibles.

The countries that still have coverage below 90% should intensify activities to reach that target.

Measles Elimination

With the exception of Bermuda, all countries of the English-speaking Caribbean and Suriname mobilized their manpower and material resources with the assistance of donor agencies such as CPHA, UNICEF, Rotary International, USAID, and PAHO to carry out a Measles Elimination Month in May, during which they simultaneously achieved the highest immunization coverage against measles ever recorded in the history of the entire area: a regional average of 91.4% among the large cohort of children 9 months to 15 years of age. Over 1.5 million children were immunized during this campaign, and the elimination of indigenous measles by the end of 1995 appears to be an achievable objective. The mass campaign was also intended to boost measles coverage and interrupt transmission of the virus. It is clear that the social mobilization activities carried out helped to educate and win the participation of the people of the Caribbean. "Mop-up" vaccinations are taking place in hard-to-reach areas in many countries, and overall measles coverage levels are now well above the 91.4% figure. It is very likely that measles transmission may have been interrupted in a number of countries, although only improved surveillance will allow for verification.

Fever with rash occurring 5-15 days after measles vaccination should be regarded as an adverse event and should not be counted as a measles case or be considered for collection of blood specimens for diagnosis. These cases should be recorded in a register for adverse events following vaccinations, whenever such registries exist.

The standardized case definition should be understood and used by all health workers and institutions. It was stressed that countries may wish to monitor rash and fever illnesses by a simple tally or a brief line-listing, but efforts should be focused only on those cases which actually meet the case definition for a suspect measles case: rash and fever illness with at least one of the following symptoms—coryza, cough or conjunctivitis. These cases should then be entered into the system, given an identification number and have an investigation form completed.

It will be necessary to increase the number of reporting sites throughout the subregion, with the inclusion of private practitioners and pediatricians who are the most likely health care providers to see imported cases.

The timeliness of weekly reporting needs to be improved.

Aggressive mop-up vaccination should be initiated as soon as a suspected measles case is detected. For the present it is expected that the suspected cases most likely to be confirmed are those in unvaccinated children under 15 years of age or those in young adults. It is therefore critical that aggressive outbreak control be undertaken particularly when such cases are detected.

There is a need to strongly encourage the complete collection of information on case investigation forms and laboratory report forms. The availability of detailed information on each case will allow a better understanding of the disease and direct the adequate measures, both to adjust the surveillance system and to implement control measures.

Social mobilization needs to continue to maintain public interest and vigilance.

The goal for measles vaccination should be 100% of the children under 2 years of age. Given the new epidemiological situation, consideration could be given to start vaccination at 12 months of age, in order to increase vaccine efficacy.

1992

February 1992
Volume XIV, Number 1

Jamaican Measles Surveillance System

The Americas-wide polio eradication campaign and the CARICOM goal of eliminating indigenous measles by 1995 call for strong surveillance systems. CARICOM countries have focused on building and improving these systems for several years now. Evaluations are used to test their adequacy and pinpoint weak areas. Jamaica, which is the largest of the CARICOM members, carried out a comprehensive evaluation of its surveillance system from October to November 1991, with an emphasis on determining its capacity to detect and investigate suspected cases of measles. The evaluation was conducted by the Epidemiology Unit and EPI Division (MCH) of the Ministry of Health with PAHO technical collaboration.

Scope of the Evaluation

The Jamaican surveillance system is based at the parish level and uses the notification system, the sentinel sites system, active hospital surveillance, laboratory reporting, and special surveys. The evaluation studied the first three components through site visits to each of the thirteen parishes that make up the country. The evaluation team interviewed Medical Officers of Health and Senior Public Health Nurses, and reviewed written records.

Notification System: The notification system classifies diseases according to the frequency with which they are to be notified. Class I diseases are to be reported on suspicion and require immediate investigation. Class II diseases are reported weekly by line listing, and Class III diseases are reported by numbers only on a monthly basis. Measles was recently elevated to a Class I disease in order to succeed in its elimination by triggering a prompt public health response and to obtain records of investigation results.

The evaluation of the notification system detected its weak point: notification follow-up, or case investigation. Of 208 suspected cases of measles reported in 1991, only 6 (<3%) were investigated within 48 hours and only 76 (36.5%) were investigated at all. Of those suspected cases that were investigated, 23 were confirmed. As a result of these findings, health authorities are now attempting to ensure that all reported cases are investigated promptly.

The majority of cases that were investigated serologically were actually rubella. This finding indicated that clinical diagnosis of measles is not as accurate as had been supposed and that blood sampling is essential to confirm the elimination of measles.

Sentinel Site Reporting: Each parish has one or more designated sentinels, which include health centers, hospitals, or a physician. Each of the 44 sentinel sites is charged with collecting a weekly count of the number of cases of fever, gastroenteritis, and measles. Unlike the notification system, the purpose of sentinel site reports is to monitor trends, not to generate investigations.

The evaluation found that 39/44, or 87% were reporting weekly. Case definitions for these reports varied, as did other information. "Fever" was found to imply fever alone in 7/12 parishes and fever with rash in 4/12. In one parish, fever and rash were reported separately. Gastroenteritis was reported consistently by all sentinel sites as three loose stools over a 24 hour period. Measles, too, was reported consistently—as clinical suspicion—although this definition lends itself to some variation between observers.

Hospital Active Surveil1ance: The hospital active surveillance system calls for public health staff to visit hospitals weekly to review cases of targeted diseases that are found on the wards and in casualty registers.

The evaluators found that at least one hospital was visited regularly in each parish in 1991. Inspection of measles data, with the purpose of evaluating the consistency of the reports found that 10/13 visit reports collected patient identification data (name, age, sex, address), 10/13 established the date of onset of illness, 4/13 included vaccination history, 7/13 outcome, and only 5/13 included final or discharge diagnosis. The lack of laboratory confirmation and final diagnoses indicated that the hospital reports were based on suspicion and not confirmation of measles.

Overall Efficiency

Of all of the cases reported through Class I notification, only 50% reached the central level. Furthermore, since Sentinel reports are only a sample of around 10% of health care sites, the fact that they reported more cases of measles than did the Class I notification system indicates that there is under-reporting by the latter. Lastly, detailed information was given only for 13 of 208 reported cases, making it impossible for evaluators to examine the remaining 195 suspected cases retrospectively.

Reporting of suspected rubella cases fared no better than that for measles (less than 50% reached the central level), but 57% of the cases reported to the EPI unit were confirmed, as compared to 11% confirmed cases for measles. Many of the cases that laboratory tests showed to be rubella were initially reported as "query measles and/or rubella." This confirmed the need to investigate all cases and to include serologic testing for confirmation.

TABLE 1. Number of measles cases reported, January-October, 1991.

Level	Number reported	Line listed	Confirmed	Laboratory confirmed
Parish	208	47	23	1
Ministry	104	104	1	1
Sentinel	317	0	0	0

Source: EPI, CAREC/PAHO.

TABLE 2. Number of rubella cases reported, January–October 1991.

Level	Number reported	Line listed	Confirmed	Laboratory confirmed
Parish	132	36	31	24
Ministry	49	49	28	28

Source: EPI, CAREC/PAHO.
Source: CAREC Surveillance Report, Vol. 17, No. 10 and 11, 1991.

April 1992
Volume XIV, Number 2

Tenth Technical Advisory Group (TAG) Meeting on Vaccine-Preventable Diseases

The Tenth Meeting of the PAHO Technical Advisory Group (TAG) on Vaccine-Preventable Diseases took place in Rio de Janeiro, Brazil, from 16 to 19 March, 1992. Participants were welcomed by Dr. Carlyle Guerra de Macedo, the PAHO Director. The meeting was officially opened by Dr. Joao Carlos Pinto Dias, President of the National Health Foundation of the Ministry of Health of Brazil. A number of members of the International Certification Commission on Poliomyelitis Eradication (ICCPE) were present and met on March 19 to discuss the findings and provide recommendations for the certification process.

MEASLES

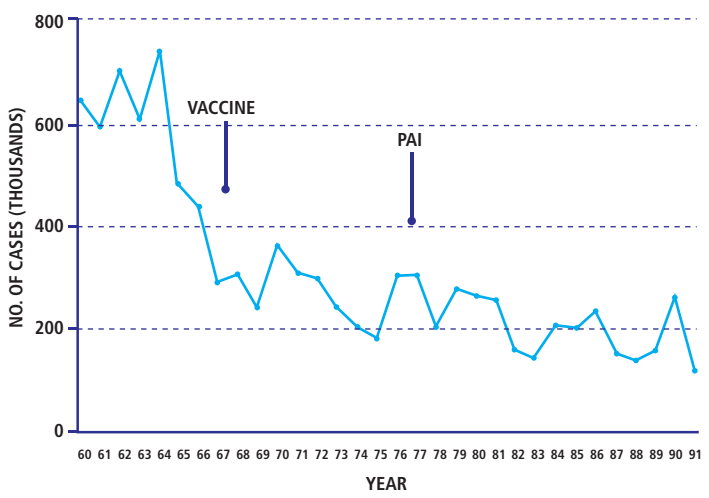
Overall incidence of measles in the Americas continues to diminish and the patterns of outbreaks show a tendency toward longer interepidemic intervals (Figure 1). In order to get a better picture of the changes in measles epidemiology and adjust control activities, high priority should be given to obtaining minimal surveillance information (age, date of onset, vaccination status, date of vaccination) for all measles cases, particularly during outbreaks.

The recent measles elimination initiative in the English-speaking Caribbean appears to have been successful in interrupting measles transmission in some countries which followed the month-long, mass vaccination strategy. Experience gained from this initiative, and from others to come should be used to learn about the process and solve the problems unique to measles elimination; to reinforce measles vaccination and control efforts; to strengthen the surveillance systems; and to address issues of sustainability.

The Director of PAHO convened a group to review the measles initiatives currently underway and those being planned by several other countries, which met in Washington, D.C. on 28 February 1992. The TAG endorsed the conclusions and recommendations of the meeting:

1. The Group recognized that PAHO has historically played a lead role in the control of vaccine-preventable diseases. The Region of the Americas was the first continent to become free of smallpox; it developed several strategies that led to greatly improved immunization programs, such as the institution of a revolving fund for vaccine purchase. It was also the first Region to prioritize the development of surveillance within national immunization programs, and to decide on poliomyelitis eradication (the strategies now being applied globally were developed in the Region of the Americas). In this context, PAHO's efforts to enhance measles control, possibly leading to global eradication, would be yet another 'first.'
2. The Group emphasized the fact that of all known microorganisms, the measles virus is the most serious resulting in more deaths than any other. Measles vaccination programs thus command the highest priority. Measles causes a substantial health burden in both developed and developing countries. Not surprisingly, data from recent studies of the cost-effectiveness of health interventions shows measles vaccination to be the most cost-effective medical procedure in terms of adding discounted healthy life years (DHLY). It was shown to be more effective

FIGURE 1 Reported measles cases, Region of the Americas, 1960-1991.*



* Preiliminary data for 1991.
Source: PAHO.

than interventions such as neonatal care, vaccination against other vaccine-preventable diseases, and other child health interventions such as ORS therapy and ARI antibiotic therapy.

3. Given the fact that man is the only host for the measles virus, that the illness is short-term and followed by permanent immunity and that a highly protective (over 90% efficacious) vaccine is available, the Group agreed that interruption of measles transmission is theoretically possible and has been achieved in some areas for limited periods. However, this has never been done over a wide geographical area. Thus, there is utility in determining the feasibility of achieving this objective in selected areas and countries.

4. The Group considers that these efforts to enhance the control of measles with actions that are designed to lead towards its elimination should be supported by PAHO. It therefore recommends that PAHO give support to the initiatives already under way in Cuba and the English-speaking Caribbean and those already planned in Brazil, Chile, and the Central American countries, as they represent valuable steps towards assessing the feasibility of elimination of measles throughout the Western Hemisphere.

5. These initiatives should be pursued within the context of the overall PAHO policies of strengthening the health infrastructure and decentralizing services. The impact on measles morbidity and mortality should serve as a surrogate to the performance of the immunization program as a whole.

6. As lessons are learned and barriers are further identified and removed, PAHO should continuously reassess the feasibility and timing of an elimination goal for the Western Hemisphere.

June 1992
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The Fight Against Measles Continues: Brazil and Chile Carry Out Mass Vaccination Campaigns

Chile: 6 to 16 April 1992

The epidemiologists of the Ministry of Health analyzed available data, trends, and statistical sequences of measles epidemics of the last decades. They observed a trend toward two-year epidemics with three-year inter-epidemic intervals (Figure 1). The most recent epidemic of 1988-1989, regretfully caused 82 deaths and a total of 58,057 cases reported throughout the country.

Both the trend analysis and the calculations of susceptibles accumulated during the past three years (Table 1), led the epidemiologists to predict that an epidemic would occur between August and September of 1992, which could potentially affect up to 70,000 cases. In order to prevent the epidemic and deaths and severe sequelae among the younger populations affected, which in turn create great consternation among the populace which increases pressure on health establishments, and given the data available on the unique capacity of mass campaigns to interrupt transmission, the Ministry of Health decided to hold a National Campaign for Measles Vaccination. The plan was to hold a ten-day campaign, between April 6 and 16, 1992, targeting 3,869,387 children between nine months and 15 years of age (28.9% of the total population) for vaccination.

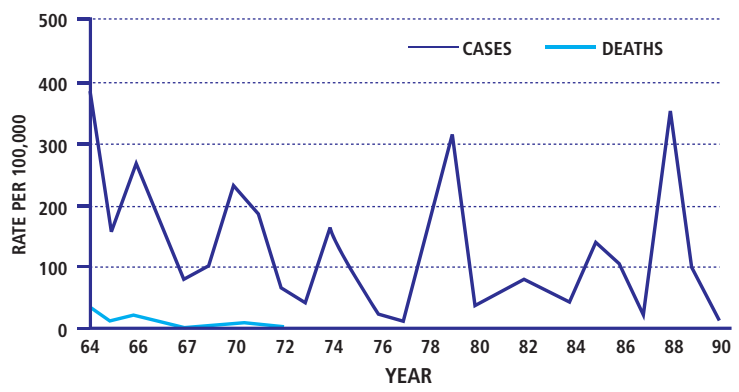
Given the magnitude of this historical task, the Ministry personnel decided to enlist the participation of all 26 Health Services as well as the pediatric community to inform the public and social organizations and institutions of the health threat facing the nation. They also intended to have them collaborate in the vaccination of all children in the targeted age group as the population most susceptible to become ill and die from this highly contagious disease.

With this goal in mind, the Ministry, along with the Health Services, implemented all the measures necessary to supply health establishments with the needed cold chain equipment, and the community with free measles vaccine. They also acquired sufficient supplies of syringes and disposable needles to have each child vaccinated and avoid any risk of transmitting other communicable diseases such as AIDS or hepatitis.

Following is a summary of the most important coordinated activities sponsored by the Ministry of Health for implementing the national campaign:

1. Creation of a National Commission that would coordinate activities in the areas of training and promotion, adjustment of human and financial resources, supply cold chain equipment, transportation, and the development, analysis and evaluation of information.
2. Through the Department of Epidemiology, the Ministry of Health elaborated a plan of activities designed to coordinate actions with the 26 Health Services, the first of which was a meeting held on January 10, 1992, attended by two representatives of each Health Service. On March 25, regional meetings were held where the representatives informed regional personnel regarding the plan of action for the campaign.

FIGURE 1 Measles morbidity and mortality, Chile, 1964 -1990.



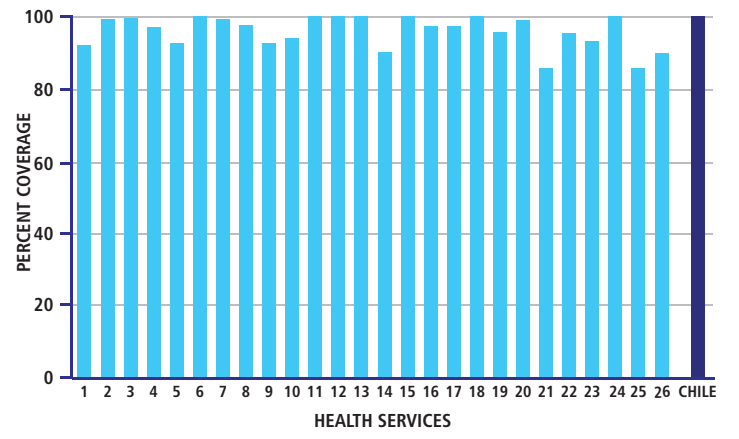
Source: Ministry of Health, Chile.

TABLE 1. Population under one year of age with and without measles vaccine and accumulated susceptibles.

Year	Pop.	Vacc.	Not vacc.	Coverage %	5% not immun.	Suscep. pop.
1989	280,813	259,418	21,395	92.4	12,971	34,366
1990	290,389	280,972	9,417	95.8	14,049	23,466
1991	300,827	287,290	13,537	95.5	14,364	27,901
TOTAL	872,029	827,680	44,349	94.9	41,384	85,733

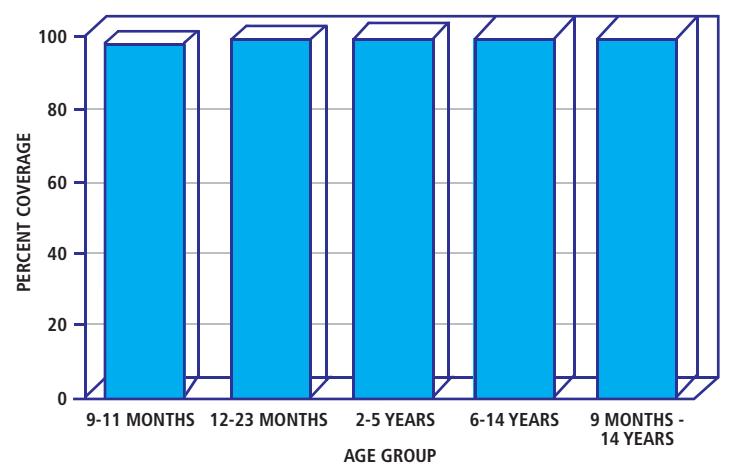
Source: Ministry of Health, Chile.

FIGURE 2 Vaccination coverage by health service, measles campaign, Chile 1992.



Source: Ministry of Health, Chile.

FIGURE 3 Vaccination coverage by age group, measles campaign, Chile 1992.



Source: Ministry of Health, Chile.

3. A social communication plan was also put into effect, in which prestigious children's television artists made announcements for TV, radio, and newspapers, and brochures, posters, and pamphlets were developed and given wide distribution. After being vaccinated, the children received a sticker with the words: "I am vaccinated, goodbye measles."
4. Extensive social participation in the campaign was enlisted through the recruitment of various public and private organizations, county governments, the police department, the Red Cross, civil defense, firemen, Caritas-Chile, and political parties. Universities, scientific societies, professional associations and private health institutions also participated in the social mobilization efforts.
5. Intersectoral coordination and participation were also accorded high priority, especially among the Ministry of Health and the Ministries of Education, Justice, Defense, Transportation, and Telecommunications.

Campaign results are presented in Figures 2 and 3. The total cost is estimated to have mounted to about US$ 1.6 million dollars, and the total vaccination coverage to 99.6% of the target population. Active surveillance of rash and fever illness was implemented immediately following the campaign, with the ongoing collaboration of PAHO.

By achieving the established target and avoiding a national epidemic, the country as a whole has taken the first step towards measles elimination.

Brazil: 25 April to 22 May, 1992

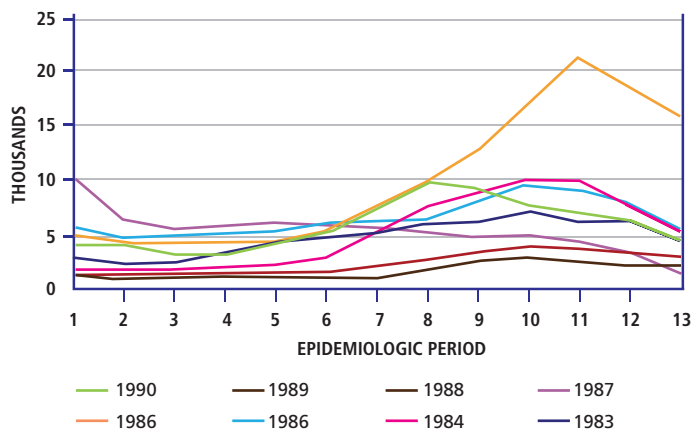
In mid-1991, the Ministry of Health decided to implement an initiative directed at improving the control of measles in the national territory. Retrospective analyses of data for the last 10 years revealed that measles had an average annual incidence of 40 cases per 100,000 inhabitants. But the problem of underreporting was a well-recognized one and it was estimated that this reported incidence constituted between 5 and 10% of the real incidence.

Ministry personnel studied data on measles control programs in the U.S. in the 1980's, the Cuban experience and data on the recent mass vaccination initiative of the English-speaking Caribbean. Data from the campaign carried out in 1987 and 1988 in the states of São Paulo, Parana and Bahia were also reviewed. The best documented and most extensive campaign hitherto conducted in Brazil was carried out in São Paulo in 1987, where more than eight million children from 9 months to 15 years of age were vaccinated. The average number of cases admitted to hospitals in this state had been 3,666 between 1979 and 1986. Following the campaign, this number came down to 247 between 1988 and 1990. An important proportion of the cases reported after the vaccination campaign occurred in laborers immigrating to São Paulo from other states, especially from Northeastern Brazil. A consulting group of technicians from the Ministry of Health, CDC, and PAHO, concluded that given the considerable migratory flow to São Paulo from other states (approximately 30,000 people arrive daily by bus alone), transmission could not be interrupted in São Paulo as long as the other states did not make special efforts to control measles.

On the basis of these data, the Ministry decided to organize a mass measles vaccination campaign that would be carried out during the first semester of 1992. The selection of the first semester was based on the fact that available data indicated that incidence was lower during the first semester in all years analyzed (Figure 4). The objective was to vaccinate all children between nine months and 15 years of age, regardless of measles vaccination history.

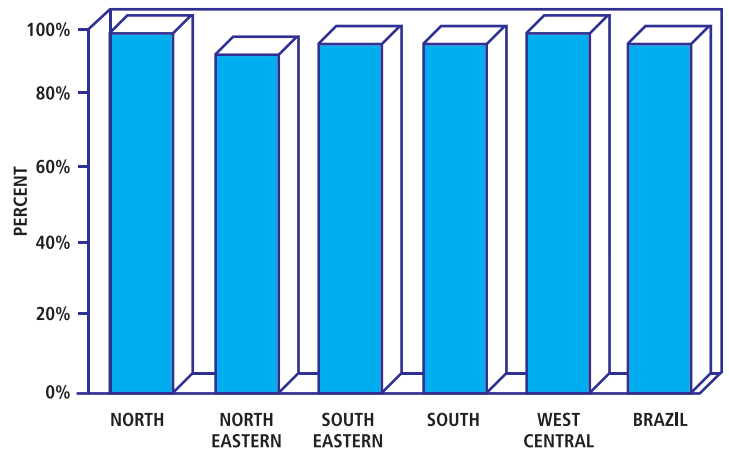
A national interdisciplinary coordinating group was organized with personnel from the National Immunization Program, the National Center for Epidemiology, the Program for Vaccine self-sufficiency, technicians from the laboratories of the National

FIGURE 4 Reported cases of measles by four-week period, Brazil, 1983–1990.



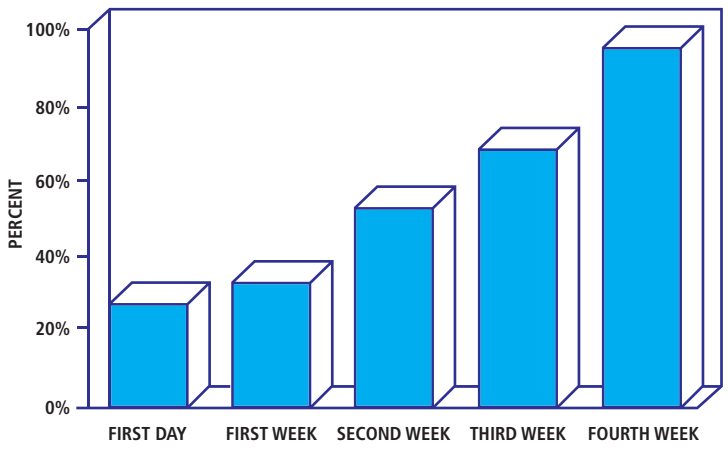
Source: Ministry of Health, Brazil.

FIGURE 6 Vaccination coverage by region measles campaign, Brazil, 1992.



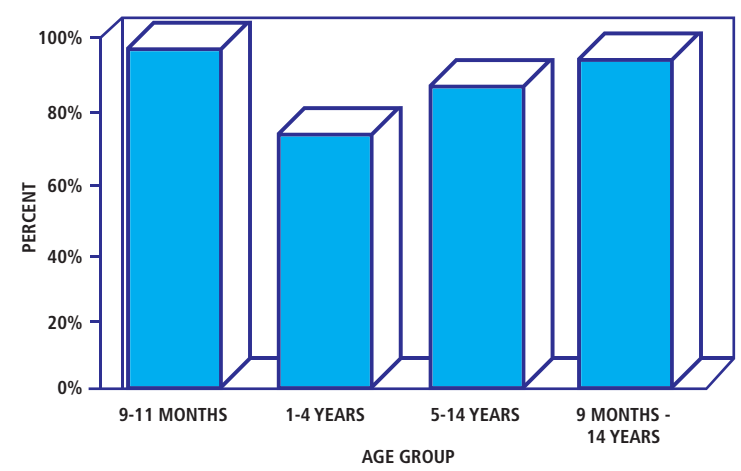
Source: Ministry of Health, Brazil.

FIGURE 5 Vaccination coverage by week of measles campaign, Brazil, 1992.



A total of 47,723,333 children were vaccinated in the campaign.
Source: Ministry of Health, Brazil.

FIGURE 7 Vaccination coverage by age group, measles campaign, Brazil, 1992.



Source: Ministry of Health, Brazil.

Health Foundation, and representatives from PAHO and UNICEF. The group was divided into three subgroups, each one charged with specific areas of action, and met as a whole on a weekly basis to evaluate the work and accomplishments of the subgroups. The Minister of Health participated in several of these meetings.

The first group had the principal objective of obtaining the 65 million doses of vaccine that would be required to vaccinate the 50 million children in the target group, along with the 10,000 injectors necessary to administer the vaccine. It is worth noting that securing this amount of vaccine and applicators was not an easy task, and required coordinating several suppliers.

The second group was charged with organizing social mobilization and promotion efforts for the campaign. Special efforts were required to develop new initiatives that would target school-aged children and adolescents. By early February, the most popular artists had been recruited to promote the campaign. Other activities were also organized, such as presenting the campaign at the National Congress of Pediatricians and other scientific meetings. National meetings were held for the state coordinators of immunization and epidemiology programs, in which details of the campaign and the Measles Epidemiologic Surveillance Field Guide were presented. State governors and representatives of other ministries and non-government agencies were also included in the activities.

The third group was responsible for the implementation of the epidemiologic surveillance system that would allow for prompt reporting of suspected measles cases once the campaign was over. In view of the fact that measles cases rarely seek medical help or are admitted to hospitals, the group elaborated a plan to implement epidemiologic surveillance within the 4,500 counties of Brazil. They also developed a plan designed to coordinate the activities of the laboratory network which will process the blood samples of all suspected cases.

The National Health Foundation transferred funds to the state governments, which in turn, transferred them to the counties. The campaign cost an estimated 50 million dollars; that is, one dollar per child vaccinated. This amount includes vaccines, injectors, syringes, operational costs, social mobilization materials, implementation of epidemiologic surveillance, and supplies for the diagnostic laboratories. The President of Brazil addressed the public by national television and radio in order to impress upon them the dangers of the disease, the efficacy of the vaccine, the costs of the campaign, and his personal commitment to achieving measles control.

Over 200,000 vaccination posts were opened throughout the country. In the Northeastern region, where the last cases of polio occurred over three years ago, OPV was also offered to children under 5 years of age. The basic strategy used was mobile and stationary vaccination posts, but several areas also included schools as a mechanism for reaching children over five years of age.

Mass communication media were used to promote the campaign throughout the four-week period. Artists and technicians informed the public on a daily basis about advances made. Vaccination coverage was also analyzed daily in order to implement immediate corrective measures. Coverage was similar among all age groups, indicating that promotion efforts were successful in reaching small children as well as adolescents.

Since preliminary data revealed the achievement of global coverage of 85% and low coverage in some states, the Minister of Health decided to continue the campaign for another two weeks. All national and state coordinators met in Brasilia on 11 June with the purpose of analyzing results at the state and county level. The campaign was considered a success, with an average national vaccination coverage of 95% (over 47 million children) of the targeted population (Figures 5 to 7). The second stage of epidemiologic surveillance and implementation of control measures at the local level is now ready to begin.

Sources: Chile: Dr. Jorge Toro, Dr. Maria Teresa Valenzuela and Ms. Irma Canepa, Dpt. of Epidemiology, Ministry of Health. Brazil: EPI Program, Ministry of Health.

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Acceleration of the EPI in Central America

The Eighth Central American Meeting to review the progress of the Expanded Program on Immunization, the eradication of poliomyelitis, the elimination of neonatal tetanus and the control of measles was held in Panama City, Panama, from 18-19 August 1992. Joining the Central American countries as participants in the meeting were Mexico, Haiti, the Dominican Republic and the Reference Laboratory for the Diagnosis of Poliovirus, INCAP.

Control-Elimination of Measles

In the last three years there have been measles epidemics in each of the countries of the subregion, Costa Rica reported 6 340 cases with 28 deaths in 1991 (Table 1). Bearing in mind that epidemics occur in this subregion every four years, it is calculated that this year may be a "quiet" period, the stage most suited to developing a massive vaccination effort that forms part of the Elimination Plan to free Central America of this disease by 1997. Because of the high proportion of counties with coverage lower than 80% it is important to ensure the success of this initiative. For that it is necessary to place special emphasis on programming and developing complementary activities to the vaccination effort in these high risk areas.

Alternatives were discussed for the attack phase of the initiative to eliminate measles in Central America. For this activity all of the 13,100,000 children between the ages of 9 months and 14 years would be vaccinated. Taking into account the seven million doses of measles vaccine that have been donated by the Government of Brazil, alternatives were discussed on how to implement the plan since 6.5 million doses are still needed to carry it out and the additional resources for the attack phase have not yet been identified. With this background two alternatives have been proposed that will be raised at the RESSECA Meeting in September 1992:

a) Postpone the attack phase until the first trimester of 1993; or
b) Develop the attack phase in two stages:
   b.1) October - November 1992, vaccination of school children (other age groups can be included if financing is available), and
   b.2) March - April 1993, vaccination of preschoolers and the rest of the school-age population.

It is important to emphasize the necessity of available resources for the two stages in September and January, respectively.

Results have been reported from the initiatives to eliminate measles in the English-speaking Caribbean, Brazil and

TABLE 1. Measles cases and rates per 100,000 inhabitants. Central America, 1985–1992.*

	1985		1986		1987		1988		1989		1990		1991		1992
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.
Costa Rica	1	0.04	4,534	120.07	3,869	141.46	347	12.39	33	1.12	75	2.55	6,340	215.57	2,100
El Salvador	1,413	25.45	278	4.86	405	6.87	787	12.91	16,536	322.03	1,124	21.89	751	14.63	330
Guatemala	2,272	28.53	1,650	20.13	400	4.74	182	2.10	2,413	27.01	8,819	95.87	206	2.18	26
Honduras	6,476	148.09	603	13.36	977	20.95	619	12.89	6,353	127.52	8,360	177.24	95	1.92	23
Nicaragua	956	29.22	2,550	75.33	792	22.62	314	8.67	381	10.17	18,225	470.83	2,867	71.69	1,845
Panama	4,295	196.93	4,199	188.55	1,885	82.86	378	16.28	301	12.70	1,891	79.79	2,430	102.53	471
TOTAL	15,420	59.06	13,938	51.88	8,552	30.89	2,701	9.48	26,028	92.04	38,564	135.71	12,696	43.73	4,835

* Information circa week 26 of 1992, ending 27 June.
Source: PAHO.

Chile and progress has been made in strengthening the epidemiological surveillance of measles in these same countries.

Strengthening the surveillance of measles is one of the essential and priority elements in monitoring the progress of the program. It is necessary to develop the basic elements of surveillance presented in the Field Guide, particularly with regard to disseminating the case definition and preparing a simple record of case investigation. Also investigators should take advantage of the low incidence of measles to use these instruments for collecting better information on each case of measles, which will then allow a better understanding of its epidemiology and will optimize control actions.

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Brazil Donates Vaccine for the Measles Campaign in Central America

The government of Brazil has made a donation of seven million doses of measles vaccine for the first attack phase of the Central American initiative to eliminate measles. Table 1 illustrates how the donations have been distributed to each country.

TABLE 1. Doses of measles vaccine donated by the Government of Brazil to the Central American countries.

Country	Population	%	Number of doses required	Number of doses donated
Guatemala	3,975,000	32	4,300,000	2,240,000
El Salvador	2,887,500	18	2,500,000	1,260,000
Honduras	2,225,000	18	2,400,000	1,260,000
Nicaragua	1,675,000	13	1,800,000	910,000
Costa Rica	1,300,000	10	1,400,000	700,000
Panama	1,037,500	9	1,100,000	630,000
TOTAL	13,100,000	100	13,500,000	7,000,000

Source: PAHO.

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Estimated Cost of Measles in Guadeloupe Based on Hospital Morbidity

On 25 September 1988, the English-speaking Caribbean nations and Suriname committed themselves to eliminate measles from this PAHO subregion by 1995. Measles is one of the diseases targeted by the EPI and the feasibility of measles elimination was confirmed in 1990, by the International Task Force for Disease Eradication.

The population movements that exist between this French Department and the surrounding CAREC countries require that surveillance and control measures be increased.

In order to support the case for the elimination campaign, it seemed important not only to show the epidemiologic data, but also the average cost for hospital treatment of a measles case.

Methods

The files of all 103 patients hospitalized with confirmed measles from 1981 to 1991 in the three pediatric wards of Guadeloupe's public hospitals have been reviewed.

Since computerized medical data are not yet available in Guadeloupe to calculate the cost of a group of illnesses, only a rough estimate could be made. This estimate was obtained by establishing the mean hospital stay of measles patients and multiplying that figure by the daily hospital rate in 1991.[1]

Data on measles obtained from the sentinel physicians network[2] between 1983 and 1990 and from the vaccine coverage survey carried out in January 1992 on a cluster sample basis, made it possible to estimate the effect of an expected outbreak.

Results

The ages of the 103 children admitted for measles ranged from 6 months to 9 years. Seventy-four and one-half percent of the cases occurred in the 1-to-5 year-old age group (Figure 1).

The case distribution per year showed an endemic pattern of the disease in Guadeloupe and confirmed the outbreak reported in 1984 by the sentinel network (34 admissions and 625 notifications) (Figure 2).

The hospital stays ranged from 1 to 66 days. Eleven children were in the hospital for only one day, and 3 spent 35, 37, and 66 days in the hospital, respectively.

The hospital stay was shorter than 30 days for 97% of the 103 children (Figure 3).

The hospital stays of more than 24 hours, which seem numerous at first glance, can be explained by the occurrence of complications or the existence of a prior morbid state (sickle cell disease, for instance). The most common complications occurring were, in order of frequency: pneumonia, otitis, gastroenteritis with dehydration, convulsions, anemia, and laryngitis. Less often, measles was contracted while the child was in the hospital for another reason.

When all 103 cases are considered, the mean stay in hospital was 11.2 days; if the stays which lasted longer than one month are discarded, the mean stay was 10.6 days. Similarly, if only cases of patients hospitalized for fewer than 17 days (80% of the 103 cases) are included, the mean stay was 7.4 days.

The cost of hospitalization ranged from 1,892 FRF (for a one day stay), to 124,872 FRF (for the 66-day stay).

The total cost of hospitalization for a mean stay of 11.2 days can be placed at 21,196 FRF, and at 14,004 FRF for a mean stay of 7.4 days.

FIGURE 1 Measles in Guadeloupe between 1981 and 1991. Age distribution (years) of admitted patients.

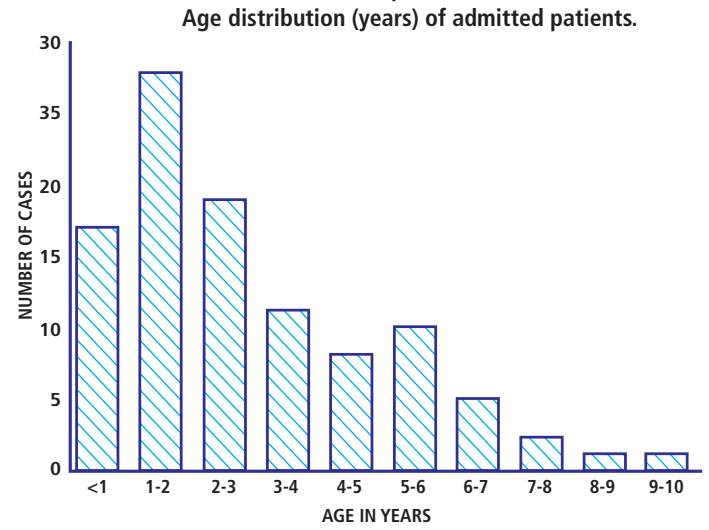


FIGURE 2 Measles in Guadeloupe between 1981 and 1991. Data from hospital admission flies and reports of the sentinel networks.

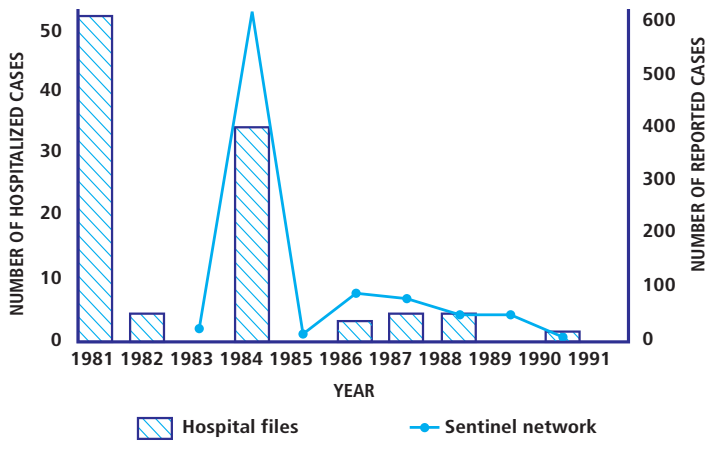
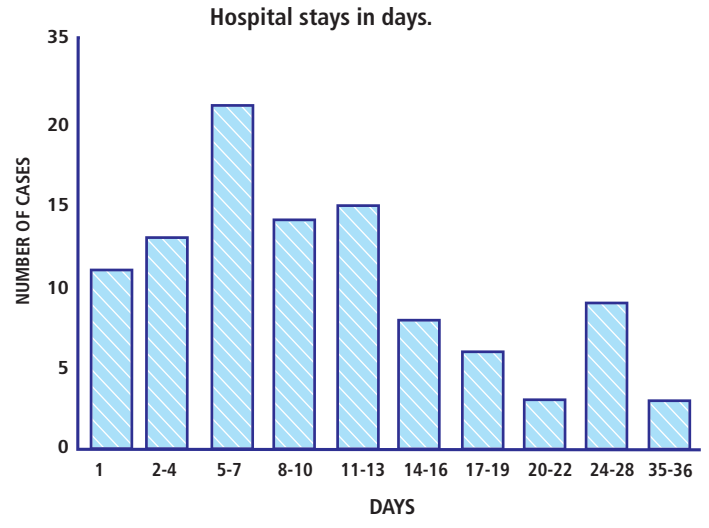


FIGURE 3 Measles in Guadaloupe between 1981 and 1991. Hospital stays in days.



This estimate does not include the cost of home care, nor does it take into account the days of work that were missed by a parent.

Thanks to data from the sentinel network and the vaccine coverage level, it is possible to extrapolate the total hospitalization cost of the next outbreak of measles in Guadeloupe. This total has been calculated using the probable hospitalization ratio and the number of susceptibles (non-immunized children). The immunization coverage survey carried out in January 1992 shows that, in Guadeloupe, 82.5% of children in the 1 to 5 year-old age group are immunized against measles. It has been established that 3 out of 4 children hospitalized for confirmed measles between 1981 and 1991 came from that age group. At present, the 1-5 year-old group contains 17.5% of all susceptibles.

An approximation of the incidence of measles can be calculated using data from the sentinel network for the 1983-1991 period. Matching these data with admissions to hospital for confirmed measles makes it possible to extrapolate the hospitalization rate by year; it ranges from 0 to 0.9%.

During the 1984 outbreak, the ratio of measles cases requiring hospital admission was 0.5%. In the event of another measles outbreak, 6120 confirmed cases could be expected, using the same ratio. With a 0.5% hospitalization rate, 31 children would require admission, at a total cost ranging from 434,139 FRF to 657,076 FRF. The smaller sum is equivalent to the cost of purchasing 8040 doses of measles vaccine, or 3455 doses of MMR from private manufacturers.[3]

Conclusions

The cost of hospital treatment for measles cases in 1992 is still high in Guadeloupe.

Routine immunization against measles began here in 1978. Although this was followed by a decrease in the incidence and a change in the epidemic patterns of the disease, the accumulation of successive cohorts of unvaccinated children may favor the occurrence of an outbreak with an excessive number of hospital admissions.

The expense incurred by these avoidable admissions would be more than sufficient to immunize all the children born in a year in Guadeloupe.

Such an expense justifies setting up a measles elimination program in Guadeloupe, in collaboration with our Caribbean neighbors. The components of this program are an enhanced surveillance system, aggressive outbreak control, and the intensification of immunization activities in order to achieve and maintain a high level of coverage.

The authors are grateful to Dr. C. Berchel, Drs. H. Loret, and G. Sybille, chiefs of the pediatric wards of Guadeloupe public hospitals; Drs. J. Armougron and V. Mazille, coordinators of the sentinel network; DDASS of Guadeloupe.

References

1. In 1991, this rate was 1,985 French Francs per day in the CHRU of Pointe a-Pitre and 1,800 French Francs in the DH of Basse-Terre.
2. This voluntary network of doctors was set up in 1983 for the surveillance of several diseases. It represents 10% of the total population of practitioners in Guadeloupe.
3. Purchase price on 01.05.92: Measles =54 FFr/dose; MMR =126 FFr/dose.

Note: This article was prepared by M. Levy, Physician and Health Inspector, and M. Theodore, Health Actions Physician. Office of Departmental Solidarity Action, General Council of Guadeloupe.

1993

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Measles Elimination in Central America

Representatives of the Central American countries that have undertaken the elimination of the indigenous transmission of measles met in Honduras from 5 to 6 July to review progress to date.

Meeting participants assessed the outcome of the campaign to vaccinate 95% of children under 15 years of age by 30 June 1993, discussed the status of the epidemiologic surveillance system to detect rash and fever illnesses, and explored ways to strengthen laboratory serology techniques to diagnose measles, rubella, and dengue.

Table 1 below shows the preliminary coverage data presented at the meeting by national representatives. A future issue of the EPI Newsletter will provide an extensive analysis of the campaign.

TABLE 1. Measles vaccine coverage or children <15 years old, target and actual rates, Central America, by country, July 1993.*

Country	Target (%) 30 June 1993	Actual coverage* (%)
Costa Rica	95	61
Guatemala	95	70
Honduras	95	95
Nicaragua	95	95
Panama	95	74
El Salvador	95	60

* Preliminary data.

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Central America: Defeating Measles

The Ninth Central American EPI Meeting, held in Guatemala from 17 to 19 August, 1993, reviewed the measures that have been taken since their elimination campaign was launched, and fine-tuned the strategies required to achieve it. Central American countries have found that if they are to succeed by 1997, as planned, they will have to push farther than ever before past the barriers of routine access to health services. National immunization programs must carry out extensive "catch-up" campaigns to vaccinate children in older age groups (1 to 14 years of age) who may not have been vaccinated or have had measles in the past. Ninety-five percent or more of all infants must then be reached and vaccinated by their first birthdays. This vaccination coverage level among one-year olds must be sustained to break the chain of transmission. The degree of consistent outreach required is the most ambitious yet of any EPI campaign.

Progress Review

The health ministries of Central America, Mexico, the Dominican Republic, and Haiti, the regional diagnostic laboratory (INCAP), the Guatemalan Social Security Institute, Rotary International, the European Economic Community, the Spanish Cooperation Agency, the Swedish International Development Agency, the U.S. Agency for International Development, UNICEF and PAHO/WHO of the United Nations were represented at the meeting to review progress to date.

The meeting focused on several main issues: the status of the effort to vaccinate all children from 9 months to 14 years of age, surveillance, and laboratory confirmation.

Increasing Coverage

The first phase of the Central American campaign launched in 1992 to vaccinate all children between the ages of 9 months and 14 years was conducted in two stages: to vaccinate school-aged children in October/November 1992, and to vaccinate pre-school and the remaining school-aged children in March-June 1993.

The mass media and several companies in the private sector collaborated in publicizing the campaign widely.

TABLE 1. Number of children vaccinated and coverage by country and age group, Central America, 1992–1993.

Country	1–4 Years		%	5–14 Years		%	1–14 Years		%
	Population	Vaccinated		Population	Vaccinated		Population	Vaccinated	
Costa Rica	321,646	158,336	49	726,130	627,136	86	1,047,776	785,472	75
El Salvador	590,607	403,639	68	1,352,844	1,326,704	98	1,943,451	1,730,343	89
Guatemala	1,358,219	1,085,214	80	2,802,914	2,438,535	87	416,133	3,523,744	85
Honduras	697,669	669,327	96	1,512,449	1,443,162	95	2,210,118	2,112,489	96
Nicaragua	581,551	433,429	75	1,195,788	1,237,641	100	1,777,339	1,671,070	94
Panama	238,754	198,932	83	572,441	476,774	83	811,195	675,706	83
TOTAL	3,788,446	2,948,877	78	8,162,566	7,549,952	93	11,951,012	10,498,829	88

Source: Country Reports.

Ten million, or over 84%, of the children between the ages of 1 and 14 years old were vaccinated, although only 74.8% of those between one and four-the hardest to reach-were covered. Another 347,491 infants 9 to 11 months old were vaccinated. A breakdown of coverage levels at the municipality level, however, found that only half meet the required 80% coverage level for that age group. Thus, although an extraordinary number of children were vaccinated in a short period of time, large pockets of susceptibles remain.

Mexico will carry out a mass vaccination campaign the week of 18-23 October, targeting all 5 to 14 year-olds regardless of their vaccination history, and those 1-4 who have not yet been vaccinated.

The Dominican Republic started vaccinating school-aged children and revaccinating children under 5 years of age during 1993. Fifty-five percent of children 9 months to 14 years old were covered.

Surveillance

To measure progress and target susceptible groups accurately, good surveillance is essential. Good surveillance, in turn, requires a standard case definition and the participation of private clinicians as well as the public sector. All of the countries of the Central American subregion now have established surveillance systems for rash and fever illness, the most sensitive case definition for measles.

A weekly Central American Measles Notification Bulletin is now published in which outbreaks, and reported and confirmed cases are listed. As of 30 September, 1,586 cases had been reported for 1993, of which 634 were confirmed. In Mexico 515 cases were reported as of the same week, 108 of which were confirmed by laboratory serology, and 41 of which were classified as compatible (not analyzed in time by a laboratory, or lost to follow-up).

Laboratory Confirmation

Clinicians often confuse measles with other febrile illnesses involving rashes, especially rubella. Laboratory analysis and confirmation of suspected cases is therefore critical to determine whether an outbreak is occurring. The Swedish International Development Agency (SIDA) is helping to fund a laboratory network that will be provided with the equipment and supplies needed to improve laboratory serology techniques. Staff training in new techniques was held in August at INCAP with the support of the U.S. Centers for Disease Control and Prevention.

Source: IX Meeting of the EPI for Central America, 17-19 August, 1993, Guatemala, Guatemala. Final Report.

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EPI Reviews

The countries of the Andean Region, the Southern Cone, and Brazil recently held their yearly EPI review meetings. Brief summaries of the final reports are presented below. The full reports may be obtained by sending requests to the editor of the EPI Newsletter.

Southern Cone, Bolivia and Brazil

Representatives of Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay met in Porto Alegre, Brazil from 14 to 16 September 1993 to review the status of their polio eradication, neonatal tetanus control, and measles elimination efforts. The meeting was presided by

Dr. Joao Batista Risi, Jr., a member of the Technical Advisory Group (TAG). Rotary International, UNICEF, and the Government of Mexico were also represented.

Overall, it was noted that the polio eradication effort has had a major impact in raising coverage levels for all EPI antigens.

Measles

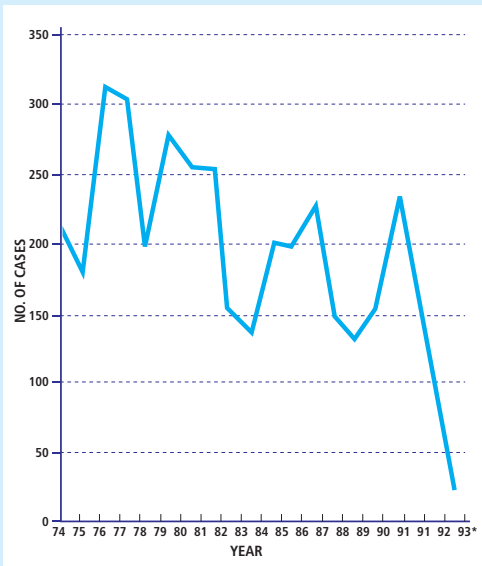
Argentina, Brazil and Chile have held national vaccination campaigns to reach the 1 to 14 year-old age group, with a success rate of around 96%. They are now in the process of establishing rash and fever surveillance. Paraguay is the only country of the Region that has seen a rise in the number of cases of measles. Since measles there could be imported to neighboring countries, meeting participants underlined the importance that both Paraguay and Uruguay carry out national campaigns. Bolivia has schedules its campaign for April, 1994.

It was recommended that those countries that have embarked on a measles elimination program should maintain 100% coverage levels for each cohort of children under 1 year of age. Sufficient vaccine supplies must be guaranteed to make this possible. Countries should document all measles outbreaks, analyze their epidemiologic traits, and notify neighboring countries when they occur at border sites.

Colombia and Peru undertook national mass vaccination campaigns targeting children aged 9 months to 14 years They achieved 96% and 66% coverage rates, respectively. Bolivia, Ecuador and Venezuela will soon initiate similar campaigns.

PAHO urged that the countries involved also assign sufficient resources to ensure that rash and fever surveillance gets under way as soon as possible. To make feedback possible, it was recommended that weekly national measles surveillance bulletins be issued.

Measles in the Americas



* Preliminary data.

The number of cases of measles has declined steadily throughout the Americas as vaccination coverage has increased and elimination initiatives have gotten underway. The speed with which unvaccinated children add up to a sizeable group of susceptibles, however, means that outbreaks still occur on a regular basis. The wave-like pattern with which measles has declined illustrates the point. Although each peak is lower than the one preceding it, epidemics such as those experienced a few years ago in Brazil, Chile, and the U.S.A attest to the fact that the virus continues to circulate and will cause outbreaks whenever a sufficiently large number of unvaccinated children builds up.

Despite progressively higher coverage rates, the build-up of groups of unvaccinated children remains the major reason outbreaks still occur. To prevent outbreaks high coverage levels must be maintained among each new cohort of infants born yearly, surveillance must be fine-tuned to pinpoint any pockets of susceptibles that require special vaccination efforts, and, depending on the situation, mass vaccination campaigns may be needed periodically.

Unvaccinated children also tend to have the least access to and are hardest to reach by any health service. Special outreach approaches are required to extend vaccination services to them.

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Global Advisory Group: Immunization Needs Strengthening

The XVI EPI Global Advisory Group held its annual meeting in Washington, D.C. from 11 to 15 October. More than 90 participants from around the world took part in discussing the main issues: the eradication of polio by the year 2000, the elimination of neonatal tetanus and significant reduction of measles by 1995, immunization in urban areas, control of hepatitis B, and vaccine self-sufficiency. The final report will be issued at the end of 1993 by EPI/WHO, Geneva. The salient conclusions and recommendations are paraphrased below.

Approximately 2.9 million childhood deaths due to measles, neonatal tetanus, and pertussis, and about 400,000 cases of paralytic poliomyelitis are prevented each year at current levels of immunization. The World Bank has identified immunization as one of the most cost-effective public health interventions. Yet 2 million children continue to die annually from vaccine-preventable diseases. Additional resources are urgently required to meet national vaccine coverage targets. The GAG was concerned by the failure to move beyond the 80% coverage target achieved in 1990. Low immunization coverage is a recipe for trouble, as the diphtheria epidemics in certain Eastern European countries demonstrate. In settings where the primary care infrastructure and management is not yet fully developed, the delivery of immunization should not be delayed awaiting their completion.

National governments should urgently identify reasons for persistently low or decreasing coverage and design solutions. Vaccination coverage and disease incidence should be assessed ward-by-ward in urban areas, with special attention to "hard-to-reach" populations, such as transient or displaced persons.

At the same time, sustainability through vaccine self-sufficiency should be fostered.

Measles, one of the greatest killers of children in history, continues to cause significant death and disease. Routine coverage with measles vaccine of 90% or more in the first year of life is essential for its control. Reaching the children of the urban poor requires special efforts. Mortality from measles can be reduced by proper management and all severe cases in areas with high case-fatality rates should be treated with vitamin A.

Source: Draft Summary of Conclusions and Recommendations, Expanded Programme on Immunization Global Advisory Group, October 1993, Washington, D.C

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Andean Ministers Resolve to Eliminate Measles

At their XVII meeting, held in Cuenca, Ecuador, on 3-5 November 1993, the health ministers of the Andean Region approved the following resolution to eliminate measles from their countries by 1998.

The XVII Meeting of Ministers of Health of the Andean Region,

Considering:

That the countries of the subregion are determined to

reduce infant morbidity and mortality, as one of the most important goals in its health policies.

That measles is one of the most common causes of death despite the availability of the technology to prevent and control it.

That it is necessary to adopt joint decisions toward eradicating this disease to accelerate the process of reducing infant mortality.

Resolves:

1. To declare the 1994-1998 quinquennium the period to eradicate measles, which the countries of the Andean subregion jointly commit themselves to attain by means of the mass vaccination of the population aged 9 months to 14 years old and the execution of subsequent epidemiologic surveillance activities including the assessment of the immunologic status of the susceptible population.
2. To request PAHO/WHO, UNICEF, and other international technical and economic cooperation agencies to join this effort, according to the Plan of Action approved by the countries and the worldwide commitment to reach Health for All by the Year 2000.
3. Place the Executive Secretariat in charge of this Resolution.

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Colombia: Measles Elimination Month

Between May 10 and June 5, 1993, Colombia carried out a "National Month for the Elimination of Measles," the goal of which was to administer one dose of vaccine to each of 11,450,861 children between the ages of 9 months and 14 years, no matter what their previous vaccination or immune status.

The campaign took place in three planned stages:

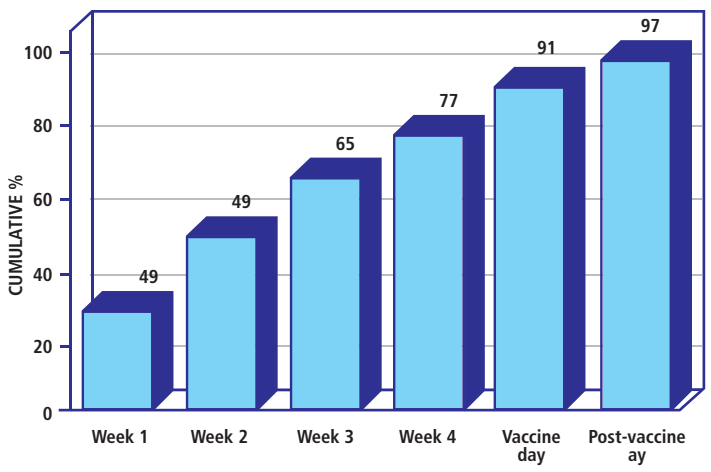
- The pre-Vaccine Day phase (May 10 to June 4) during which it was hoped to cover 100% of school children. A coverage rate of 77% was achieved (Figure 1).

- The Vaccine Day (June 5), which was primarily based on setting up vaccination" posts and attained 91% coverage.

- The post-Vaccine Day phase, beginning on 6 June, which was considered complete when at least 95% of the goal was reached. During this phase, sweeps were conducted in areas that had already been covered, as well a as hard-to-reach areas. Ninety-seven percent of the goal was achieved.

Figure 1 shows the goals achieved. Vaccinations reached 11,096,264 children. The remaining 352,237 were vaccinated in a nationwide mop-up campaign during which other EPI antigens (OPV, OPT) also were administered. The health units throughout the country attained the following coverage: 52.2% achieved rates over 95%, 26.3% obtained rates between 90 and 95%, and 18% remained under the 90% target.

FIGURE 1 Measles elimination campaign, Colombia, May 1993. Percent vaccinated by week period.



Source: EPI Colombia, Ministry of Health.

The cost of the campaigns was US$ 5,547,931 for supplies and equipment and that much again for operational expenses. The budget was shared by state and city governments, non-governmental organizations, and the health sector.

Around 20,000 health personnel from the public sector took part in the Elimination Month. They were joined by private health practitioners, and staff from the national security, and social welfare programs.

The campaign was closely coordinated with the Colombian Family Welfare Institute, the Communications Ministry, the National Education Ministry, scientific organizations, health unions, and the mass media. The coordination and the accompanying social mobilization was headed by the Interinstitutional and Intersectoral Committees of the health sector at the state and municipal level. Community Participation Committees also took part.

Source: EPI Program, Ministry of Health, Colombia, and Patricia Gonzalez, EPI Program Ministry of Health/ UNICEF.

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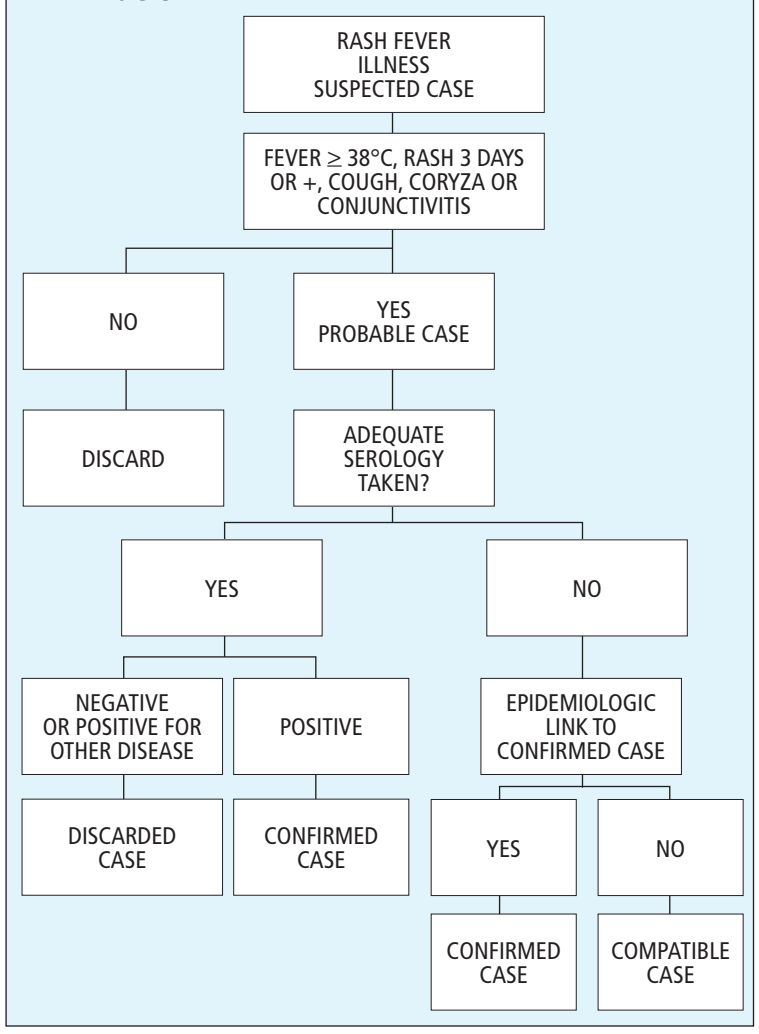
Colombian Pediatricians Join In

Measles continues to be the cause of considerable morbidity and mortality among children. Due to the highly infectious nature of the measles virus, even small numbers of sick children can start an outbreak.

One of the missing links in the surveillance system required to mount such an effort is the irregular reporting by pediatricians who still consider measles a common childhood disease. Special publications such as "May, The Month of Measles Elimination"* issued in 1993 by the Colombian Pediatric Society make critical contributions to measles elimination. In it the Colombian Pediatric Society pledges its full support for the measles elimination campaign and issues clinical and epidemiologic guidelines for pediatricians to participate fully in the case reporting system.

* Copies of the special issue "May, The Month of Measles Elimination" (ISSN-0120-4912) may be obtained by writing to: Dr. Gina Tambini, EPI, c/o PWR Colombia, Calle 95 No.9-80, Santafe de Bogota, D.C. Colombia.

Rash and Fever Case Classification for Measles Elimination



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Mexico: Field Manual on Measles

The health ministry of Mexico has undertaken the elimination of measles from the entire country. The campaign will be based on raising and maintaining high vaccination coverage rates, establishing a highly sensitive surveillance system, and taking immediate control measures whenever cases, outbreaks, or special situations occur. The system set up to carry out the job includes a National Laboratory Network for the Epidemiologic Surveillance of fever and rash illnesses, the decentralization of surveillance, and a computerized database.

To standardize the information that is used to this end, in 1993 the ministry issued two simplified manuals for the epidemiologic surveillance of measles, one for private clinicians and one for all participants in the national fever and rash reporting system. The manuals provide the PAHO case definition and basic procedures for the notification, investigation, and follow-up of cases. Brief and precise, the booklets include the addresses and phone numbers of the principal health districts in the country to ensure the ease of reporting by persons who are not part of the health system. The manuals may be useful as models for other national elimination campaigns.

Copies (available in Spanish only) may be obtained by writing: Coordinacion Nacional para la Vigilancia Epidemiologica de las Enfermedades Prevenibles por Vacunacion, Francisco de P. Miranda 177, 6° Piso, Colonia Merced Gomez, Lomas de Plateros Mixcoac, Delegacion Alvaro Obregon, Mexico, 01480, D.F.

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Absence of Reported Measles — United States, November 1993

For the first time since measles reporting began in 1912, no measles cases have been reported in the United States for 3 consecutive weeks (November 7-November 27 [weeks 45-47], 1993). In addition, no cases have been reported with onset since September 22 that were not directly linked with importations.

Of the provisional total of 277 measles cases reported in 1993 through November 27, a total of 57 persons had onsets of illness since July 4. Of these, 29 (51 %) were imported or linked through a continuous chain of transmission to an imported case. Twelve (21%) cases resulted from continued transmission from measles outbreaks that began before July 4. Fourteen (25%) cases could not be linked to an existing outbreak, an international importation, or another reported case and were classified as sporadic index cases. Two cases were epidemiologically linked to these cases. Twelve of the 14 sporadic index cases were laboratory confirmed.

Reported by: State and local health depts. National Immunization Program, CDC.

Addendum:

Since this report was prepared, an additional 3 weeks have passed since the last case of measles reported to the Centers for Disease Control from the United States. No measles cases have been reported from the 50 states from November 7 (week 45) through December 18 (week 50).

Source: This report appeared in Morbidity and Mortality Weekly Report on December 10, 1993 (MMWR 1993;42:925-6). It was prepared by John C. Watson, MD, MPH, and William L. Atkinson, MD, MPH, National Immunization Program, Centers for Disease Control and Prevention.

Editorial Note:

The 3-week period without reported measles cases reflects at least four factors: l) major increases in measles vaccination coverage levels among preschool-aged children; 2) increased use of a second dose of measles vaccine among school-aged children and young adults attending college; 3) an overall increase in efforts to control measles throughout the Western Hemisphere; and 4) the usual seasonally low incidence of measles during the fall[1,2]. Furthermore, the absence of any reported persons with sporadic index cases of measles who had onset after September 22 may reflect a cessation of endemic measles transmission in the United States during this period.

The absence of reported endemic foci of measles transmission does not indicate that measles has been eliminated in the United States. In the past, substantial numbers of measles cases were not reported to public health authorities.[3] Therefore, surveillance must be intensified to permit the identification and elimination of any remaining foci of transmission. Any case of rash illness suspected to be measles should be reported promptly to public health authorities to enable immediate investigation and vigorous control measures to minimize spread of infection. For

continued

each case, laboratory confirmation should be obtained, vaccination status determined, and source of exposure ascertained.

Although current measles activity is at its lowest level ever in the United States, previous periods of low activity have been followed by resurgences.[4,5] High vaccination coverage levels among preschool- and school-aged children need to be achieved and sustained in all communities to ensure the elimination of endemic measles transmission.

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April 1994
Volume XVI, Number 2

Measles in Canada in 1993: The Lowest Ever Reported

Canada has set the year 2005 as the date by which it will eliminate indigenous measles. Its coverage and incidence targets are to:

1. Achieve and maintain 97% coverage with the first vaccine dose at 2 years of age by the year 1997.
2. Achieve and maintain 99% vaccine coverage for the second dose before school entry by the year 2000.
3. Achieve and maintain an incidence of less than 1/100,000 by the year 2000 in each province /territory.
4. The following is a review of current elimination efforts.

Epidemiologic situation

As of October 30, 1993, a provisional total of 174 measles cases was reported in Canada by the 10 provincial and 2 territorial health departments. This is the lowest total recorded for the first 10 months of any year since national notification began in 1924, and reflects a 94% decrease from the 2,858 cases reported for the same period in 1992. The projected incidence for 1993 is 0.7 cases per 100,000. the lowest ever reported in this country (Figure 1). The following summarizes the epidemiologic characteristics of cases reported in 1993 as well as recent developments in prevention and control strategies.

In 1993 no cases were reported from 3 provinces (Newfoundland. Prince Edward Island and New Brunswick and the 2 territories (Yukon and Northwest Territories., Ontario and Quebec (representing 62% of Canada's population) reported 80% of the total cases. In other regions, the number of cases reported ranged from 1 to 17. Compared to 1992, Ontario has experienced a 97% decline, while Quebec experienced a 23% increase.

There has been a remarkable drop in the proportion of cases occurring in school-aged children (5 to 19 years), from 83% in 1992 to 53% in 1993. Figure 2 shows the age specific incidence rates per 100,000 population. The highest rate of infections was among infants. followed by preschoolers; the rate decreased with increasing age. Additional epidemiologic information pertaining to the vaccination status of cases. the proportion of cases laboratory confirmed, and the proportion of imported or import-related cases is not currently available at the national level. The latter is not considered a significant problem. With the assistance and cooperation of the local and provincial public health departments, federal officials are hoping to intensify the surveillance of measles moving from the current passive system to an active one in the near future.

Before the introduction of vaccine, measles occurred in 2 to 3- year cycles. The highest incidence was recorded in 1935 with over 83,000 cases (770/100,000 population). The widespread use of measles vaccine since the mid 1960s has resulted in a dramatic reduction in the overall morbidity and mortality due to the disease across Canada. The introduction (timing) and implementation of immunization programs, vaccine products used, and the vaccine coverage over the years has varied greatly among the various jurisdictions. Nevertheless, the immunization programs have been progressively successfully reducing the burden associated with measles, resulting in 90% to 95 % reduction in the reported incidence in the last decade.

In the past decade, despite ongoing control efforts, continuing occurrence of cases of measles in many parts of the country at irregular intervals, and sometimes in epidemic proportions has been a major concern. Many cases, In fact, were reported to have a history of measles vaccination, having received vaccine according to the national recommendation, i.e., after 12 months of age. The generally accepted explanation for the most recent epidemics in Quebec in 1989. and in Ontario during 1990-1991, includes insufficient use of available vaccine, sub-optimal vaccination practices and vaccine failures.

A national survey conducted in the spring of 1993 indicated that 95% of the 2 to 3- year-olds had received at least one dose of measles vaccine, although only 90.5% had documented evidence of receiving the recommended 1 dose of vaccine after their first birthday. The reported vaccine coverage for most school entrants across Canada is greater than 95%.

Measles Consensus Conference And Measles Elimination Efforts

Measles prevention/elimination has been a high priority issue in Canada since the early 1980s. However, continued occurrence of measles in recent years, although confined to certain geographic areas, has been worrisome and a major concern for public health personnel. Prevention and control measures in outbreaks have been expensive and labor intensive. As a result of these concerns and to develop national goals for measles and the best strategy to achieve them, the Laboratory Center for Disease Control sponsored "National-Consensus Conference on Measles," 1-2 December, 1992.[1]

The Consensus Conference recommended measles elimination in Canada by the year 2005. To achieve this goal, implementation of a routine 2-dose schedule (the second dose to be given before school entry) was recommended. However, it was emphasized that the first priority in this schedule still remains the full application of dose one.

Canada's National Advisory Committee on Immunization has recently endorsed the Consensus Conference's recommendations, including measles elimination goal and the 2-dose routine immunization strategy. However, the final implementation of these recommendations will vary depending on the provincial/territorial government and resources. Some provinces are already taking steps towards implementing the 2- dose strategy.

Comments

To achieve measles elimination, sustained cooperation of local, provincial, national and international public health agencies is essential.

Having achieved a rate of less than 1 case of measles per 100,000 population in 1993 in all Canadian provincial/territorial jurisdictions is remarkable. If measles activity is kept at this rate or lower, this will fulfill, in part, one of the Consensus Conference's recommended targets even earlier than expected, i.e., achieve and maintain an incidence of less than 1/100,000 by the year 2000 in each province and territory.

However, past experience in Canada, as well as in the United States, cautions us that, since a resurgence of measles can happen after a period of low activity, one should not be over optimistic about elimination unless the desired level of immunity is achieved and maintained in all segments of the populations.

Acknowledgement: Assistance of all provincial/territorial epidemiologists is appreciated.

Reference

1 Consensus Conference on Measles. Canada Communicable Disease Report, 1993: 19: 72-79.

Source: Paul Varughese and Philippe Duclos, Childhood Immunization Division, Bureau of Communicable Disease Epidemiology, Laboratory Center for Disease Control, Health Protection Branch, Health Canada, Ottawa.

FIGURE 1 Measles: Reported cases, Canada, 1924-1993.

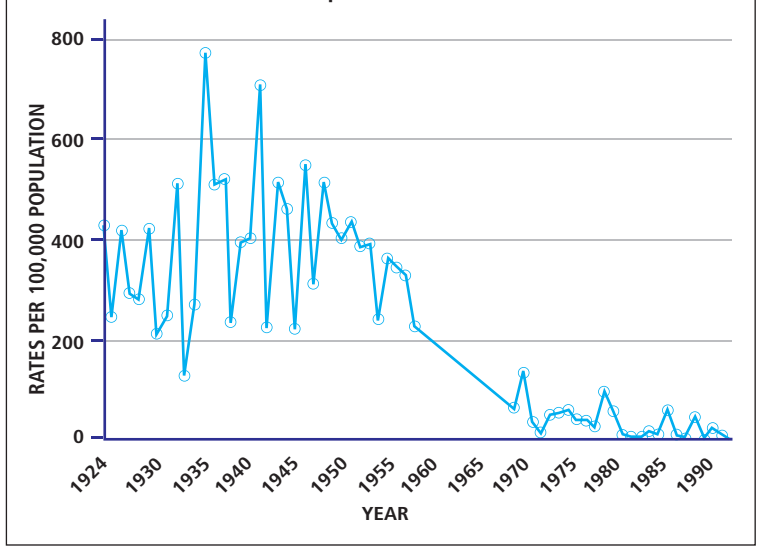
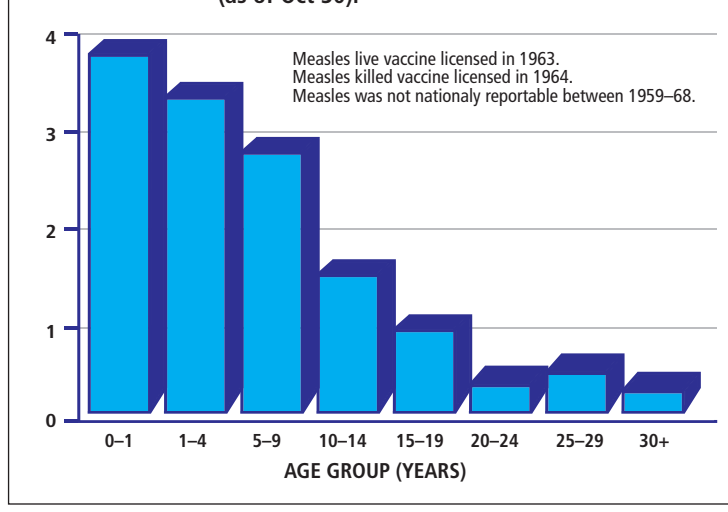


FIGURE 2 Measles: Age-specific incidence, Canada, 1993, (as of Oct 30).



June 1994
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Global Measles Strategy Picks Up Pace

Although the Region of the Americas has made major strides in the control of measles, the same is not yet true in other parts of the world. The need to improve the pace of measles control was discussed at the Informal Consultation on Strategies to Accelerate Global Measles Control, held on 27-28 April, 1994, at PAHO headquarters in Washington, D.C., by the Global Program for Vaccines (GPV) of the World Health Organization. The following summary paraphrases the main conclusions.

Forty-five million cases of measles cases occur each year; 1 to 2 million of them die. The situation in early 1994 suggests that current measles control strategies will not suffice to attain the global case reduction goals set by the World Summit for Children and the World Health Assembly.

Several important operational, managerial, structural and financial constraints have limited measles vaccination coverage. Many programs have had remarkable success in overcoming these constraints and achieving modest or high levels of coverage; in 1993 global measles vaccination coverage was 78%. However, it has become progressively clear that no matter how high coverage is, programs that rely upon measles vaccine delivered in the first year of life from fixed sites cannot expect to achieve the measles case reduction goals.

Even a vaccine coverage of 100% with an 80% effective vaccine leaves 20% of vaccine recipients susceptible to measles, permitting continued transmission in the community, and falling short of the 90% reduction goal. Further improvements in vaccine efficacy in young infants are unlikely in the near future. Existing vaccine delivery strategies should be improved and additional ones introduced, such as identifying and vaccinating high-risk groups and conducting periodic mass campaigns that target all children in a particular age group, whether or not they have been vaccinated in the past.

To improve measles control in developing countries, implementation of existing vaccine delivery strategies needs to be improved. These include delivery by fixed clinic-based services; outreach services, which offer immunization for populations away from health centers who are unable to reach fixed services easily; or by mobile teams, which operate in areas too remote to be served by fixed or outreach services.

Missed opportunities for immunization are a major impediment to improving

measles vaccine coverage. Health staff may miss opportunities to immunize by accepting false contra-indications. Eligible children should be immunized despite a history of having had measles. Managers should be alerted if measles vaccine coverage rates are found to be significantly lower than coverage for BCG or DPT-1. Recent program reviews indicate that some countries experience a 25% drop-out rate between DPT-3 and measles vaccine. Managers must investigate the reasons for high drop-out rates and take appropriate action.

In addition to improving what already exists, additional strategies must be introduced to increase measles vaccination coverage, particularly by identifying and vaccinating high-risk groups. These include areas with high population density, those in the lowest 25% in the national ranking of measles immunization coverage, areas with a history of high numbers of measles cases and/or measles deaths, urban areas with poor socio-economic and educational status, and areas with vitamin A deficiency. High-risk groups may include children who are admitted to hospital, malnourished, in displaced populations such as refugees living in camps, in zones of armed conf1ict or border areas, migrants, and members of certain ethnic and religious sub-groups.

Mass campaigns will be targeted to those age groups identified through analysis of epidemiologic data, will include children regardless of prior vaccination status, and will focus particularly on urban centers, where disease transmission is highest.

Mass vaccination campaigns provide the opportunity to reach children who may not have been vaccinated because of lack of access to services at fixed sites; to increase vaccine efficacy by providing an additional dose to some children, and vaccinate children outside the target age group; and to rapidly reduce the pool of susceptibles and potentially interrupt transmission.

The report states that mass campaigns should be used in (a) urban areas and districts with a high incidence ofmeasles; (b) countries and districts with measles vaccine coverage less than 80%; (c) countries conducting polio mass campaigns; and (d) countries with measles elimination goals, among other settings.

The epidemiology of measles suggests that urban strategies are especially important because high birth and migration rates in cities ensure a continuous supply of susceptibles; measles is transmitted rapidly in densely crowded conditions; seeding occurs from city to rural areas, and up to a third of all cases in urban Africa occur among infants younger than 9 months old.

Measles surveillance will be critical until the desired levels of reduction are reached and can be maintained by existing health infrastructures. Experience has demonstrated that the effectiveness of mass campaigns is improved by post-campaign identification of low coverage areas and intensive house-to-house vaccination.

Local analysis of measles surveillance data will guide the choice of age groups to be immunized during mass campaigns. In some situations the upper age limit may be reduced to three years of age, and the lower age limit lowered to six months. The choice will depend on the local epidemiology of measles and the resources available. Likewise, the frequency of campaigns should be determined by analysis of epidemiologic data.

The most cost-effective means of conducting a measles campaign is in conjunction with a polio vaccination campaign, according to local situations. Failure to administer measles vaccine simultaneously with OPV constitutes a missed immunization opportunity.

Sample strategies for improving measles control based on immunization coverage and population density.

Coverage	Rural districts/ regions	Urban districts/ regions
80%-100%	Routine*	Rotine*
50%-79%	Routine + Campaign every 2 years	Routine + campaign yearly
<50%	Routine + campaign yearly	Routine + campaign yearly

*In areas of high coverage, where measles remains a problem, or where elimination is a target, campaigns should be carried out.

A major impediment to achieving the goals in many countries is the continuing lack of political commitment, often linked to turbulent political events. Strong advocacy should be brought to bear to overcome this inertia. Days of tranquility or "corridors of peace" are phrases coined to denote a cease-fire declared in areas or countries experiencing civil unrest or war, for the specific purpose of immunizing all children in the conflict area, regardless of allegiance (this was done successfully a number of times in Latin America).

Additional limiting factors include a lack of funds to purchase measles vaccine and syringes and the limited health infrastructure in some key countries which reduces their potential to implement these strategies.

The cost of a measles mass campaign ranges from US$ 0.50 - US$ 0.75 per child, and, if administered during a polio mass campaign, is approximately US$ 0.30 additional per child. To improve measles surveillance the cost increases by US$ 0.05 per newborn. In general, vaccines account for about 50% of the per capita costs. Currently, measles vaccine and disposable syringes and needles (which are strongly advocated for campaigns) cost US$ 0.19-US$ 0.22. Additional costs include planning, training, transport, personnel, advocacy, and evaluation. Precise estimates of cost will be difficult to make and will vary between countries and over time. Data are available from campaigns conducted in the Americas and the Philippines.

There currently is adequate manufacturing capacity for measles vaccine to meet present and foreseeable global needs. Should a significant increase in demand occur, however, industry will require a lead time of approximately one year to prepare the equipment required to produce up to five times the present output (up to 1000 million doses annually).

An enhanced measles surveillance system is critical for planning and evaluating measles control strategies. In order to monitor the success or failure of control activities, data should be collected that help answer specific epidemiologic and programmatic questions. This should include age- and geographic-specific incidence and secular trends.

Priority surveillance activities include strengthening the routine notifiable disease reporting system; using sentinel surveillance; periodic outbreak investigations (to verify information related to age distribution and vaccine efficacy); and linking measles surveillance with the polio/AFP active surveillance system.

Proper case management and aggressive treatment of complications can substantially reduce measles mortality. In vitamin A deficient areas and in areas with high measles case-fatality rates, administering vitamin A immediately upon diagnosis is an integral part of measles case management and should be done whenever a patient has a severe case of the disease. Hospitalized children or children admitted to clinics for severe measles with complications should also receive a second dose of vitamin A on the day following admission.

Timely and realistic planning is essential to effective measles control. Such planning needs to be based on area specific information on disease epidemiology, coverage, and resource availability. Campaign planning requires the identification and allocation of tasks to the multiple partners involved in implementation: political, health, private sector, religious organizations, and private voluntary groups. Success is greater if this planning is decentralized to the level of implementation.

At the national level, elements that have been identified as essential include political commitment to measles control; a national plan with goals, targets, policy, and strategy; a financial plan with a budget, authorization, and monitoring system; a vaccine procurement inventory system ensuring procurement, storage, and distribution of adequate quantities of vaccines; a quality assurance system to assess program implementation; vaccination coverage and disease occurrence monitoring and the use of the data to assess and adjust immunization strategies and delivery; coordination of international, bilateral, and PVO inputs; an operational, data-driven, problem-solving strategy aimed at goal and target achievement.

Success in measles control will occur as countries and partners work together to understand disease epidemiology; develop realistic, technically feasible, logistically practical, affordable strategies; and recognize and fulfill their unique implementation responsibilities.

Source: Final Report of the Informal Consultation on Strategies to Accelerate Global Measles Control, Global Program for Vaccines (GPV), World Health Organization, Washington, D.C., 28 April 1994.

June 1994
Volume XVI, Number 3

Chile Averts Measles Outbreak

The health ministry of Chile successfully put known measles epidemiology to the test and found it works: an imminent outbreak was averted and lasting interruption of the virus' circulation may have been achieved. The following is a brief report.

Health personnel knew that the 2- to 3-year epidemic periodicity of measles meant that an outbreak could be expected in 1992. Although coverage levels had hovered around 90% since the last epidemic, an outbreak could occur among those who had not been vaccinated in that period or those who failed to seroconvert. To prevent an outbreak, health authorities decided to organize a National Campaign that would vaccinate 95% of all children aged 9 months to 14 years of age—3,930,000 of them—in two weeks. The target was surpassed: 99.6% of the children were immunized with a standard dose, regardless of their previous vaccination history.

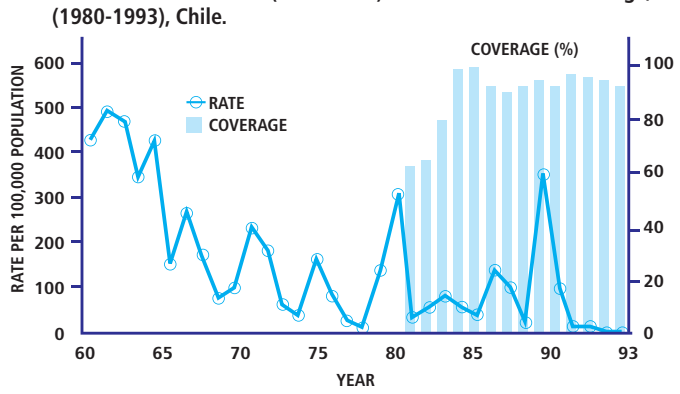
Post-campaign epidemiologic surveillance of rash and fever illness was carried out from April 17, 1992 with the organization of laboratory diagnostic capabilities. Compliance with the probable measles case definition nearly doubled between 1992 and 1993, and the proportion of probable measles cases for which blood samples were taken increased from 64% to 79% for the same period. The decline in compatible cases (such cases represent failures of the surveillance system) from 8% to 5% between 1992 and 1993, is a good indicator of improving surveillance. From the time the campaign was organized to the end of 1993 only 2 cases of measles were confirmed; both were imported.

Source: Adapted from Ministry of Health reports, Chile.

Editorial Note:
Chile appears to be the first mainland country in Latin America to have arrested epidemic transmission of measles virus for more than 18 months. Their experience offers several useful pointers for other countries that have embarked on the elimination of measles, particularly regarding the challenge of setting up a system for the active surveillance of rash and fever illness.

Major efforts must be made to disseminate the measles surveillance case definition (see the February, 94 issue of the *EPI Newsletter*) and obtain compliance in reporting the critical clinical information for each case.

Measles incidence rate (1960-1993) and immunization coverage, (1980-1993), Chile.



An adjustment period is required between the time a standard case definition is adopted and the time it is applied routinely by health personnel. During 1992, when reporting units were still adjusting to the use of a standard case definition in Chile, many excess "probable" cases were reported that did not meet the case definition.

Priority should also be given to ensuring that adequate blood samples are taken before a case is discarded. The importance of

continued

laboratory backup for measles surveillance was underlined in Chile as well: the alternative final diagnosis for a large percentage of probable cases was determined by laboratory analysis.

Lastly, one of the main purposes of surveillance is to carry out active searches and vaccinate all susceptibles as soon as a probable case is reported. This is the best way t;) eliminate pockets of susceptibles that may have been missed during a campaign.

September 1994
Volume XVI, Number 4

The TAG and ICCPE Meet Together to Review the Status of Polio Eradication and the EPI

The Eleventh meeting of the PAHO Technical Advisory Group (TAG) on Vaccine-Preventable Diseases and the Third meeting of the members of the International Commission for the Certification of Poliomyelitis Eradication (ICCPE) were held concurrently in Washington DC, USA, from August 22nd to August 25, 1994.

The following is a summary of the major highlights of this meeting regarding measles elimination.

Measles Elimination: Is the Road rReady?

Three countries in the region, Cuba, the English-speaking Caribbean, and Chile, appear to have reached and sustained transmission interruption for more than six, three, and two years, respectively. Chile represents the first non-island setting were transmission has been interrupted for more than one year. In Central America the number of cases has been drastically reduced and virus circulation appears to have been interrupted in some countries. In other countries measles transmission has been reduced to a few foci where cases and limited outbreaks continue to occur. In most of these countries the surveillance system of the fever and rash diseases with laboratory diagnosis capabilities are being put into place and are reporting weekly cases.

Only Venezuela and Haiti have yet to launched their National Campaigns against Measles. Nearly 80% of children under the age of 15 in all the other countries of Latin America and the Caribbean have received a single dose of measles in the last three years.

Both the U.S. and Canada have set goals for the elimination of measles. In 1993 the U.S.A. reported a historical low of 312 cases of measles (1.4/1 million). School entry laws had ensured measles vaccine coverage in school aged children over 95%.

Canada also set a goal for the elimination of indigenous measles by the year 2005. After two years, however, despite a vaccine coverage in excess of 97%, epidemics continue to occur as a result of a combination of factors. Primary vaccine failures account for the majority of these occurrences, while others mostly involve unvaccinated individuals and occur in communities with documented measles immunization coverage up to 99.7%. This evidence links most cases, then, to importation from outside the country or from one province to another.

The TAG made the following recommendations in relation to measles:

Nearly every country in the Region has now set an elimination target for measles. The individual country efforts could be enhanced by undertaking a regional elimination initiative. Such an initiative could help answer questions regarding surveillance of rash and fever, laboratory diagnosis, and most effective vaccination strategy(ies) to interrupt transmission. Continued efforts should be made to a achieve and maintain the highest possible levels of vaccination coverage.

September 1994
Volume XVI, Number 4

Measles Outbreak—Huehuetenango, Guatemala

From April-May 1994, a measles outbreak of 190 cases, including 4 deaths. occurred within three municipalities (Todo Santos. Huehuetenango. and Chiantla) of the Huehuetenango Health Area in Guatemala. Rural health promoters initially alerted the non-governmental organization. Doctors without Borders, about the outbreak who then provided the first information to the Health Area Headquarters. The information provided indicated that three villages in the municipality of Todo Santos appeared to be the center of the outbreak. On the 27 of May 1994, the EPI coordinating unit of the Guatemalan Ministry of Health first received information about the outbreak.

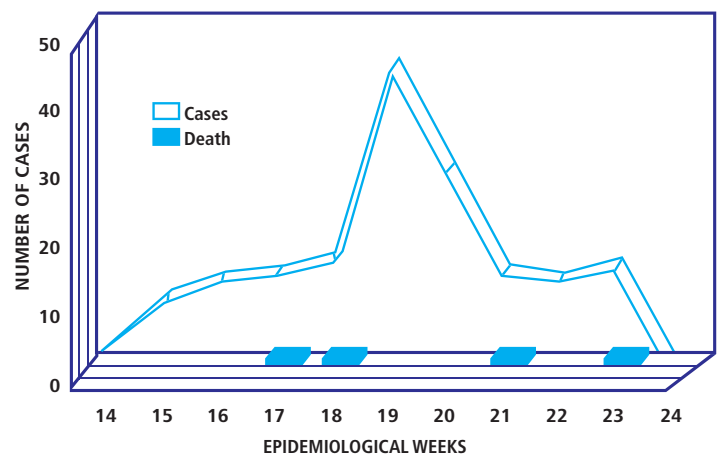
Todo Santos Municipality

Health personnel from Huehuetenango Health Area Headquarters, visited Todo Santos municipality and confirmed that during May 1994, 29 cases, including one death, meeting the measles clinical case definition, had occurred in children less than 10 years of age.

Available vaccination coverage data from this municipality indicated that 64% of all children 1-14 years of age had received one dose of measles vaccine during the mass campaign held in 1992-1993; coverage data for children under one year of age was reported to be 62%.

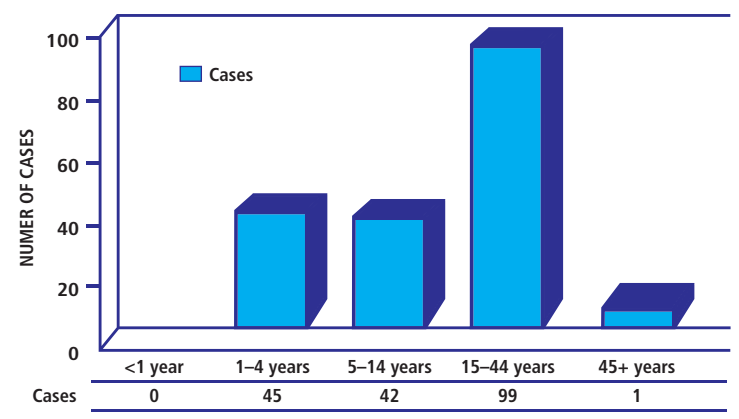
The first case in Todo Santos municipality occurred around the 1st of May 1994. None of the reported cases had a history of measles vaccination. The affected children were not vaccinated primarily because of religious objections to vaccination. In response to this measles outbreak, health workers implemented control measures and vaccinated all children less than 15 years of age, regardless of their previous vaccination history. The community gladly accepted the opportunity for vaccination fearing that they could be infected by the disease.

FIGURE 1 Measles cases and deaths. Huehuetenango, Guatemala. Weeks 14-24, 1994.



Source: Health Area Headquarters, Ministry of Health Guatemala.

FIGURE 2 Distribution of measles cases by age group. Huehuetenango, Guatemala. Weeks 14–24, 1994.



Source: Huehuetenango Health Area Headquarters, Ministry of Health Guatemala.

Huehuetenango Municipality

Further investigation revealed that one death occurred due to a secondary infection with pneumonia in a military recruit with recent history of measles in a hospital at the military base located in Huehuetenango municipality. The investigation also revealed that there were 94 cases of rash and fever illness with clinical characteristics compatible with measles as diagnosed by military physicians. Of the total patients reported with measles, 25 patients had rash and fever at the time of the investigation.

The first case in Huehuetenango municipality had rash onset on April 6, 1994, 51 days before the health services of the Guatemalan Ministry of Health were notified. The outbreak investigation revealed military personnel had been in contact with the three villages in the municipality of Todo Santos.

To control the measles outbreak in this military community, immediate vaccination of all military personnel was begun, as well as, demobilization of all military personnel until the epidemic subsided. All active cases were directed to the hospital for treatment.

Chiantla Municipality

Active search for suspected measles cases was intensified throughout the Huehuetenango Health Area. A further 67 cases of rash and fever were identified, with one death reported in five communities within the municipality of Chiantla. However, only nine cases had rash that was compatible with the clinical measles definition.

Data obtained from the community indicated that cases occurred between epidemiologic weeks 20 and 23 (16-29 May 1994). A "mop-up" vaccination effort in Chiantla municipality to vaccinate all children less than 15 years of age began on the 1st of June.

Outbreak Summary

Figure 1 shows the epidemic curve for the outbreak which shows that the peak occurred around epidemiologic weeks 19 and 20 (4–16 May, 1994).

A total of 19 blood samples were collected from suspected measles patients in Huehuetenango Health Area. Of the total samples tested, 12 (63%) were positive for measles IgM.

Age data are available for 187 cases out of the 190 reported cases. The majority of the cases occurred in the 15-44 years age group (Figure 2).

Since week twenty-four, no cases of confirmed measles have been reported from these three municipalities. Active search for further cases and outbreak control measures have continued. Guatemalan Health authorities have kept in close contact with Mexican officials, but to date no related cases have been reported from Mexico.

The Huehuetenango Area Health Headquarters investigation report concluded that the Guatemalan measles outbreak began in early April 1994 primarily among unvaccinated

military personnel. Of the total cases reported, 52% occurred in military personnel. A majority of the cases occurred between epidemiological weeks 18 and 21 (11–27 May).

The report concluded that military personnel represented a pocket of susceptible persons that introduced the virus into neighboring rural villages. Measles transmission was facilitated in these civilian communities because of the low rates of measles vaccination coverage among children less than 15 years of age.

The report also concludes that there was lack of coordination between the different health services of the Ministry of Health and that of the military which explains the reason why the outbreak was not detected in a timely manner and thus permitted the measles transmission to continue.

Source: Huehuetenango Area Health Headquarters and the Division of Surveillance and Control of Diseases, Ministry of Health, Guatemala.

Editorial Note:

This is an excellent report which provides important information concerning the epidemiology of measles in Central America. Based on the Guatemalan experience, the following general conclusions can be made:

1. This outbreak highlights the importance of regularly monitoring vaccination coverage by municipality and organizing "mop-up" campaigns for those municipalities with low coverage following a mass vaccination campaign.
2. Religious groups with objections to measles vaccination are a high-risk group for measles infection. Efforts should be made to educate these groups about the measles elimination activities and to encourage them to vaccinate their children.
3. Because of the high transmissibility of measles virus, persons living in densely populated closed communities, such as military camps, may be at increased risk for measles. Consideration should be given to routinely providing measles vaccination to new military recruits.
4. Strong collaboration and communication are needed between various groups to achieve improved measles control and its eventual elimination. It is critical to improve the coordination of activities of groups including the Ministry of Health, schools, the private sector, and the military.

October 1994
Volume XVI, Number 5

Measles Elimination by the Year 2000!

Following the successful effort to eradicate the wild polio virus from the Americas (See EPI Newsletter, Volume XVI Number 4, 1994) the 24th Pan American Sanitary Conference (PASC) resolved to set the target to eliminate measles from the Americas by the year 2000.

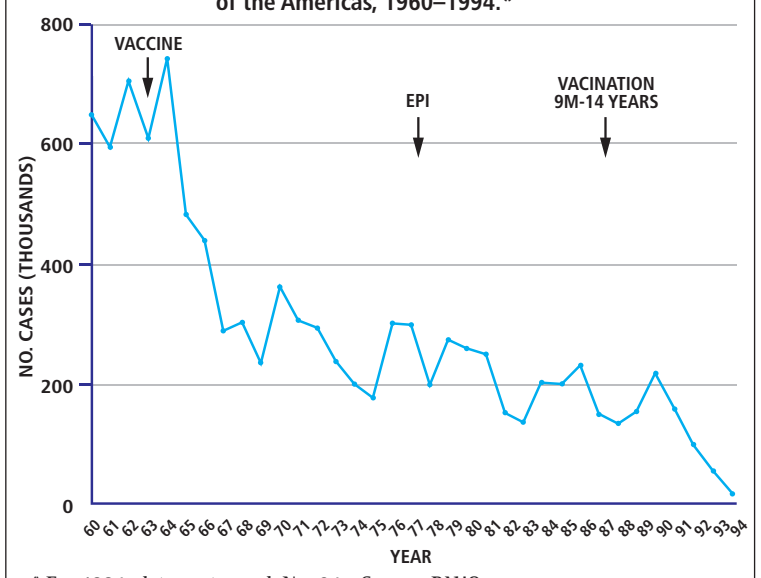
Efforts to control measles began as soon as the vaccine was licensed in 1963. As the vaccine became more widely available and the governments in the Region began to include the vaccine in their immunization programs the reported number of cases began to decrease dramatically between 1964 and 1969. See Figure 1.

In 1970 the Ministers of Health developed a Ten-Year Health Plan and sct the goal of reducing measles mortality to a level of 1.0 cases per 100,000 by 1980. However, no sound control strategies were implemented and this goal was not attained. Only Bahamas, Barbados, Canada, Cuba and the United States were able to reach this goal. In 1977, the EPI was established in the Americas and the coverage with measles began to improve. At the end of the decade of the 1970's, coverage data available indicated that the coverage with measles vaccine was not uniform throughout the Region nor within the country themselves. At the end of 1980 vaccine figures from the different countries showed vaccination coverage for children 12-23 months ranged from a high of 67% for two regions in Costa Rica to 31% for children in Santo Domingo in the Dominican Republic. As the use of measles vaccine in national immunization programs began to improve during the decade of the 1980's, measles vaccination in children under 12 months of age increased to 53% by 1984. By 1990 measles vaccine was being administered to 76% of children under 12 months of age.

However, by 1984 it was evident that the Region began experiencing cyclical epidemics of measles outbreaks every 3-4 years despite the increase in coverage. See Figure 1. In fact, measles epidemics appeared in countries like the U.S. with measles coverage rates superior to 95%. These epidemics were caused by the accumulation of large pools of susceptibles over a period of time due to unimmunized individuals. Also the age of disease incidence was being modified. Measles outbreaks and sporadic cases began to be seen in older age groups.

In 1986, Cuba decided to eliminate measles, and with technical support from PAHO launched a strategy where all children between the ages of 9 months and 14 years of age were vaccinated with measles

FIGURE 1 Number of mealses cases notified, Region of the Americas, 1960–1994.*



* For 1994, data up to week No. 34. *Source:* PAHO.

vaccine independent of their previous vaccination status or disease history. The strategy was aimed at eliminating the pockets of susceptibles that potentially formed chains of disease transmission. Thereafter, each new cohort of newborns would have to be successfully vaccinated in order to prevent a build up of susceptibles.

In 1988, the Ministers of Health of the English-speaking Caribbean followed suit and launched a measles elimination effort using the same strategy. The Caribbean initiative, besides securing the technical cooperation from PAHO was financially supported by Rotary International and the Canadian Public Health Association (CPHA).

This strategy proved to be effective and soon thereafter, not only did Chile, Brazil, Mexico, and Argentina but also the Central American Ministers of Health and the Andean Ministers of Health, voted to eliminate measles from their sub-regions. Between 1992 and 1994 almost every country in the Region that had declared the goal of measles elimination had undertaken the strategy proposed by PAHO of a one time vaccination of children nine months to 14 years of age followed by disease surveillance and routine vaccination of each new cohort of newborns. Both Canada and the USA have also declared measles elimination goals. The almost simultaneous undertaking by the governments of the Region in implementing the one time measles campaign within a two year period resulted in the dramatic reduction of reported measles cases in the Region as shown in Figure 1.

With the remarkable success being made against measles, the Pan American Sanitary Conference, in their meeting held in Washington D.C. in September, 1994, set the target of measles elimination for the Western Hemisphere by the Year 2000.

October 1994
Volume XVI, Number 5

Measles Update— United States, First 26 Weeks, 1994

As of July 2, 1994 (week 26), local and state health departments in 31 states had reported a provisional total of 730 measles cases[1] to CDC for 1994 (Figure 1). This represents a greater than fourfold increase over the historic low of 167 cases reported by 18 states during the same period in 1993. In addition, 250 cases were reported in 1994 for the U.S. territories of Guam (211) and the commonwealths of the Northern Mariana Islands (26) and Puerto Rico (13). This report summarizes the epidemiologic characteristics of measles cases reported in the United States for the first 26 weeks of 1994.

Characteristics

Case Classification. Of the 730 reported cases, most (696 [95%]) were indigenous to the United States, including 588 (80%) acquired in the state reporting the case and 108 (15%) that resulted from spread from another state.[2] Fifteen states reported a total of 30 (4%) internationally acquired cases-one of which initiated a college outbreak in New Jersey resulting in approximately 100 cases. The 30 international importations originated from or occurred among persons who had traveled in Asia (Hong Kong, Indonesia, Japan, Korea, and Vietnam), Europe (England, France, Germany, Spain, and Switzerland), Latin America (Dominican Republic, Ecuador, and Mexico), Canada, Iran, and Israel. Of the 30 persons with internationally acquired measles, 11 were aged <5 years; 10, aged 5-19 years; and nine, aged ≥ 20 years. Six of the 20 persons for whom data were available were U.S. citizens.

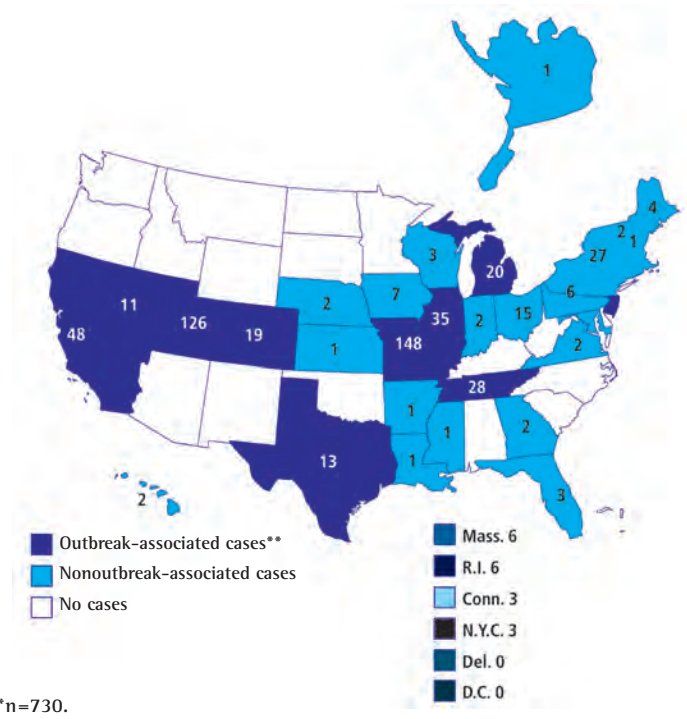
Age. Of the 725 persons with cases for whom age was known, 172 (24%) occurred among persons aged <5 years, 368 (51 %) among persons aged 5-19 years, and 185 (26%) among persons aged ≥20 years. Of the 172 cases among persons aged <5 years, 49 (28%) occurred among persons aged <12 months. Of the 71 cases for whom serologic testing for measles was reported, 70 were serologically confirmed.

Vaccination Status

Of 274 reported patients for whom vaccination data were available, 44 (16%) had received at least one dose of measles-containing vaccine (MCV) on or after their first birthday and >14 days before the onset of symptoms. A total of 81 (30%) patients considered to be unvaccinated received a first dose of MCV ≤14 days before the onset of symptoms; most vaccinations were administered during an outbreak involving previously unvaccinated persons. Five cases were reported among persons who had received two doses of a MCV; for two of these five persons, the second dose was administered ≤14 days before symptom onset.

Of the 230 patients who were either unvaccinated or vaccinated ≤14 days before illness onset, 166 (72%) had a religious or philosophic exemption to vaccination. Forty-three (19%) patients were unvaccinated but vaccine-eligible (i.e., U.S. citizens aged ≥16 months with no medical, religious, or philosophic exemption to vaccination), and 21 (9%) were younger than the recommended age for

FIGURE 1 Reported cases* of measles by state. United States, first 26 weeks, 1994.



*n=730.
**State reporting more than five epidemiologically linked cases.

Editorial Note:
Although measles incidence has increased since the historic low reported in 1993, measles incidence during the first 26 weeks of 1994 remains substantially lower than in previous years. In addition, epidemiologic characteristics of cases reported in 1994 are consistent with patterns observed since the end of the measles resurgence during 1989-1991. These patterns include 1) a shift in age incidence from preschool-aged children to older age groups, 2) the importance of international importations in the spread of measles, and 3) the spread in groups whose members do not routinely accept vaccination-in particular, cases among groups with religious or philosophic exemption to vaccination accounted for 45% of all cases reported during the first 26 weeks of 1994. Maintaining communication with these groups permits rapid detection of cases and prompt implementation of outbreak-control measures when cases occur and may encourage some members to accept vaccination.

During 1994, measles cases have occurred predominantly among high school-and college-aged persons, many of whom previously had received one dose of measles vaccine. In contrast, during the 1989-1991 measles resurgence, cases occurred predominantly among preschool-age children. Since 1991, the proportion of cases among persons aged <5 years has decreased substantially from 49%-50% during 1991-1992 to 24% during the first 26 weeks of 1994. This decline may have resulted from systematic efforts to increase measles vaccination coverage (approximately 85% in 1993) among preschool-aged children at 24 months of age.

The outbreaks among previously vaccinated high school and college-aged persons emphasize the importance of implementing and enforcing vaccination with a second dose of MCV among persons in these age groups. Findings of a recent assessment indicated that the risk of measles outbreaks is lower among colleges that enforce prematriculation requirements for measles vaccination when compared with those that do not have or do not enforce such policies.

The laboratory findings during 1994 are consistent with other epidemiologic data suggesting that measles transmission may have been interrupted in the United States in late 1993 and indicate that international importations account for a substantial proportion of disease attributable to measles in 1994. Although only one large outbreak has been epidemiologically linked to a known importation, genomic sequencing of measles viruses suggests that cases in 1994 resulted from reintroduction of measles by international importations.

Although indigenous measles transmission in the United States may have been transiently interrupted, the continued occurrence of measles among U.S. residents demonstrates that additional efforts are required to attain the Childhood Immunization Initiative goal of sustained elimination of indigenous measles in the United States by 1996. These efforts should include 1) rapid detection of cases and implementation of appropriate outbreak-control measures, 2) achievement and maintenance of high levels of vaccination coverage among preschool-aged children in all geographic regions, and 3) greater implementation and enforcement of the two-dose recommendation among high school and college students. In addition, the source of measles infection should be established for all cases to define better the chains of disease transmission and to help develop more effective control measures.

State and local health departments are encouraged to investigate thoroughly all cases to identify the source of measles infection and to obtain specimens for virus isolation. Specimens should be obtained from all sporadic cases and from selected outbreak-associated cases. Specimens may be collected from nasal washings within 1-3 days of rash onset or from urine samples within 2 weeks of rash onset. Additional guidelines for specimen collection and handling can be obtained from CDC's Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, telephone (404) 639-3512, or from CDC's National Immunization Program, telephone (404) 639-8226.

vaccination. Vaccination status varied by age group. Of measles patients aged 5-19 years, 14% had received at least one dose of MCV at an appropriate age, compared with 23% of patients aged 1-4 years.

Outbreaks

Fifteen measles outbreaks (clusters of five or more epidemiologically linked cases) were reported by 10 states during the first 26 weeks of 1994 and accounted for 82% of all cases reported for this period. Six outbreaks (range: 25–148 cases) occurred in high schools or colleges, five (range: 5-32 cases) among preschool-aged children, and four (range:5-126 cases) in other settings. All high school and college outbreaks occurred in institutions with no vaccination requirements (two institutions) or a requirement for only one dose of MCV (four institutions). Three of the largest outbreaks occurred among persons who do not routinely accept vaccination in St. Louis County, Missouri (148 cases, high school); Jersey County, Illinois (52 cases, college); and Salt Lake County, Utah (126 cases, community). In addition to these outbreaks, a large outbreak (approximately 200 cases) occurred predominantly among preschool-aged children in Guam.

CDC performed genomic sequencing of measles viruses isolated from seven outbreaks in the continental United States during 1993-1994. Preliminary analysis indicates that all of the viruses from these recent outbreaks (most from 1994) are genotypically different from viruses isolated during the 1989-1991 measles resurgence. All viruses obtained during 1989-1991 were closely related by sequence analysis, even though they were obtained from cases in different geographic regions. In contrast, isolates from recent U.S. outbreaks were genotypically similar to viruses from European or Japanese sources.

Reported by: State and local health depts. L Espadon, MD, Guam Dept of Public Health and Social Svcs. BJ Francis, MD, State Epidemiologist, Illinois Dept of Public Health. HD Donnell, Jr, MD, State Epidemiologist, Missouri Dept of Health. CR Nichols, MPA, State Epidemiologist, Utah Dept of Health. National Immunization Program; Measles Virus Section, Respiratory and Enteric Viruses Br, Div of Viral and Rickettsial Diseases, National Center for Infectious Diseases, CDC.

Source: Morbidity and Mortality Weekly Report, September 23, 1994/ Vol.43/ No.37; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services! Public Health Services, Atlanta, Georgia.

1 Comprises cases reported to CDC's National Notifiable Diseases Surveillance System through July 2, 1994 (week 26), and cases reported subsequently that occurred during this period.
2 Acquired in another state or linked within two generations to an out-of-state importation.

December 1994
Volume XVI, Number 6

Summary of Caribbean Managers Meeting

The Eleventh Meeting of the Caribbean EPI Managers was held in Nassau. Bahamas, from 14-18 November 1994. Throughout the meeting, various points of achievement were noted. These included the fact that no cases of indigenous measles have been reported in over 3 years in the Caribbean, despite intensified surveillance for measles with nearly 600 units reporting each week in the English-speaking Caribbean and Suriname. Also, nearly 12 years have elapsed since a reported case of paralytic poliomyelitis was detected in the Caribbean. Remarkable progress has been achieved in surveillance of fever and rash illnesses and immunization coverage levels remain high throughout the

Caribbean and the Americas.

The Meeting was attended by over 80 participants from the 19 countries of the English-speaking Caribbean and Suriname; representatives of the French Departments of Guadeloupe and French Guyana as well as from Curação and St. Maarten also attended the meeting. For the first time and following recommendations of previous meetings, representatives from Puerto Rico attended the event. Several NGOs, including Rotary International and the Christian Children's Fund were also in attendance. Technical personnel from PAHO and its Caribbean Epidemiology Center, UNICEF, and CPHA, were active participants in the Meeting as well.

An extraordinary level of commitment was clearly evidenced by the high quality of presentations and by 100% participation of member countries. Governmental commitment was evidenced by allocation of resources which have accounted for approximately 90% of the cost of the program over the last few years, as well as personal involvement of political leaders in support of the program.

The role of international supporting agencies was noted as an important factor in the progress achieved thus far and their continued support will be fundamental for further gains.

The principal purpose of the Meeting was to review the overall EPI program in the Caribbean and to identify obstacles which might impede achieving program targets. To assist in this identification country reports and the 1994 National Work Plans were reviewed and analyzed. This exercise resulted in the elaboration of the 1995 National Work Plans.

Another major objective of the Meeting was to evaluate continued efforts towards the elimination of measles by 1995, focusing on various limitations related to surveillance of suspected measles cases and incomplete laboratory specimen collections. The key issue of the continued build up of susceptibles was addressed, with each country determining the number of potential susceptibles in their country, and whether a catch-up vaccination campaign was necessary. Also addressed were issues pertaining to the maintenance of the absence or wild poliovirus transmission in the region.

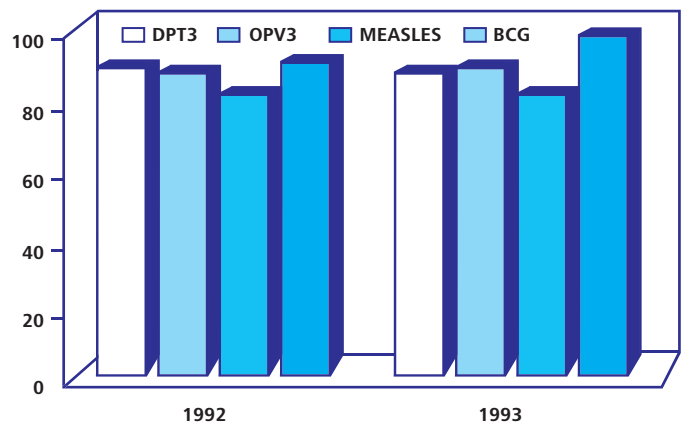
Surveillance

The continued implementation of and improvements in the surveillance system for detection of suspected measles cases was evidenced by improved weekly reporting and training in operational procedures related to surveillance and case investigation. The meeting stressed the critical role that CAREC should play in helping to strengthen the surveillance of vaccine-preventable diseases in the Caribbean, both in terms of organization and maintenance of the reporting networks and analysis of the data to allow for refining strategies for disease control and elimination.

It was noted that a great number of measles epidemiological investigation forms are not being sent to CAREC. This has greatly impeded the analysis and evaluation of data for the entire Caribbean. Without such data it is difficult to asses trends and make group policy and strategy decisions. Nevertheless, based upon data available collected and analyzed from laboratory forms a number of indicators related to the laboratory results were presented. These included the fact that for the period January to October, 1994, a total of 187 out of 220 (94%) of suspected cases had an S1 sample obtained and submitted to CAREC (4 of the 33 which were without specimens were cases which did not require an S1, such as cases incorrectly reported as suspected). Of the 187 S1, 114 (60%) had S2 submitted and of the other 73 S1, 27 were without specimens due to cases not requiring an S2, for example, confirmed rubella diagnosis with S1. Also the interval between rash onset and collection of S1 was under 8 days in over 85% of cases. 50% of all S1 specimens taken were received within a two week period at the reference laboratory. Over 40% took longer than 3 weeks to have specimens received in CAREC. 50% of S2 was collected within 2 weeks after collection of S1.

It is important to note that in some countries the private medical practitioners (PMD) are not yet fully incorporated in the system, and additional efforts should be made to achieve this objective. In a

FIGURE 1 Vaccination coverage EPI vaccines, 1992–1993. English-speaking Caribbean and Suriname.



Source: Ministries of Health, 1994.

TABLE 1. Projection of children under 5 years of age who would be susceptible to measles by June 1995 (4 births cohorts born since May 1991).

Country	Annual births	Percent not vaccinated	Projected Susceptible <5 years age*
Anguilla	159	0	96
Turks and Caicos	286	10	258
Montserrat	186	0	112
British V.I.	320	1	202
Cayman Islands	550	2	363
Saint Kitts and Nevis	1,000	1	630
Antigua and Barbuda	1,284	0	770
Bermuda	954	15	1,002
Dominica	1,652	7	1,339
St. Vincent and The Grenadines	2,640	9	2,297
Grenada	2,372	13.5	2,384
St. Lucia	3,690	15	3,875
Belize	7,781	20	9,337
Bahamas	6,500	9	5,655
Barbados	4,097	9	3,564
Suriname	9,000	26	12,420
Guyana	21,344	20	25,613
Trinidad and Tobago	23,000	20	27,600
Jamaica	60,000	20	72,000
TOTAL SUSCEPTIBLES			169,517

*Projection based on a) 10% vaccine failure for 3 births cohorts, b) percent unvaccinated for 3 births cohorts, and c) 30% of one birth cohort (the 30% figure represent the estimated number of infants under 12 months of age which may be susceptible at any given time). The estimated total number of susceptibles is calculated as ((3 x annual births) x 0.1) + (0.3 x annual births) ((3 x annual births) x % unvaccinated).

region that is apparently free from indigenous transmission and with a very heavy influx of outside tourists, it is likely that cases of fever and rash illnesses would first be seen by a private medical practitioner, therefore, underscoring the importance of their participation in the system.

Some countries are having very good progress incorporating the PMD. The key to their success has been good coordination, training and permanent contact and feed back.

Another aspect that merits action is evaluation of the surveillance system with respect to the ZERO reporting. It is crucial that ZERO actually reflect the absence of suspected measles cases and not the routine submission of a negative report.

Coverage and Susceptibles

Overall, immunization coverage has been maintained at the previous high levels already achieved (see Figure 1). However, it was reported by some countries that coverage had either dropped or remained stationary under the 90% mark. When coverage is less then 95%, this indicates that there are considerable numbers of unvaccinated children.

Despite improved coverage a yearly increase of approximately 30,000 susceptibles are likely to be added to this total (from each new birth cohort. those not vaccinated and those that represent vaccine failures). Such a number of suceptibles are more than sufficient to support a considerably large epidemic should a measles introduction occur. This estimate does not include an unknown number of susceptibles in the greater than 4 years of age sector of the population.

With the above background information, each country estimated the number of likely susceptibles in the <5 population. It was determined that if there was an average of 20% susceptibles in the birth cohort over the last 4 years, then the build up of susceptibles over a 4 year period is critical enough to warrant a catch-up campaign targeted to the under 5 age group. Countries which do not exceed this limit still need to identify smaller pockets of susceptible, such as areas with urban poor and remote or inaccessible locales, where vaccination activities should be aggressively implemented to deal with these groups (See Table 1).

An analysis of the Caribbean measles situation was made. As immunizations are given in most countries at 1 of age, there are approximately 150,000 infants (all less 1 year of age) at any given time unimmunized in the Caribbean. If it is assumed that approximately 30% of these infants are unprotected either by lack or loss of maternal antibody at sometime during their first year of life, this would provide up to 45,000 susceptibles at any given time in the under 1 age group. As the mass campaign provided vaccine to all persons 1 to 15 years of age in May 1991, it is likely that at that time the number of susceptibles in that age group were dramatically reduced. However, there are factors which prevent 100% of the target population from being immune; 1) vaccine is not 100% effective, 2) as coverage has been less than 100% since the campaign, there is a likely build up of additional susceptibles with each successive birth cohort, and 3) potential cold chain problems.

Based on these 3 factors one might estimate that 20% of the 1-15 age group is susceptible. For the 3 years since the campaign there have been approximately 450,000 births, and if approximately 20% are not protected, this would add up to 90,000 susceptibles. If we add this number to the 45,000 susceptibles under 1 year of age, there may be as many as 135,000 susceptib1es at any given time in the Caribbean.

Social Mobilization

Continued Social Mobilization and NGO involvement and enhanced participation are essential to the goals of the EPI, improving coverage and the maintenance of the eradication of polio and the elimination of measles. With regard to measles, social mobilization is critical to increase the population's consciousness about the need to have children of any age taken to a health authority when rash and fever occur. To achieve this end, innovative approaches, similar to those developed in Jamaica, must be taken on a continuous basis. These include the use of media and community groups in addition to a special school program which develops materials intended to heighten the awareness of school children about the importance of immunizations.

World Health Day will be celebrated in April 1995 and will focus on progress towards global polio eradication. This is an excellent opportunity for re-vitalizing a variety of aspects related to the EPI program, including coordination between the countries and donor agencies in relation to dissemination of social communication materials for this event.

December 1994
Volume XVI, Number 6

Measles in Canada, 1994 (as of September 14)

From January 1 to September 14, 1994, a provisional total of 358 measles cases have been reported in Canada. This is 108% higher than the 172 cases reported for the same period in 1993. Over 65% (258 cases) of these cases were reported from Ontario, followed by Quebec with 25% (98 cases). No cases have been reported from Prince Edward Island, New Brunswick, the Yukon, and the Northwest Territories.

The province of Quebec recently reported two outbreaks, one of which involved a group of people who oppose immunization for religious reasons. Although several Ontario health regions have reported sporadic cases (peaking in the last week of May). A brief report follows in this issue on the latter outbreak.

Figure 1 shows the distribution of cases by month of onset for the period January 1 to July 31, 1994. The highest number of cases (145) was recorded in May, followed by June (89 cases).

Ages of the cases ranged from 5 months to 57 years (median: 13). The highest proportion (38%) of the cases was among those aged 15 to 19 years with the greatest incidence occurring among those 16 years of age, followed by those 5 to 9 years old (22%). Infants <1 year of age accounted for 14 cases (4%) (Figure 2). No deaths have been reported.

Immunization Status

Of the 358 cases, 339 were eligible for measles vaccination, i.e., they were born after 1957 and were older than 12 months of age. Two hundred and ninety-two (86%) of this vaccine-eligible group had a documented history of immunization - a pattern expected due to the high immunization coverage of a vaccine with <100% vaccine efficacy. Immunization history was not known for 32 of the cases (8.9%)

Comment

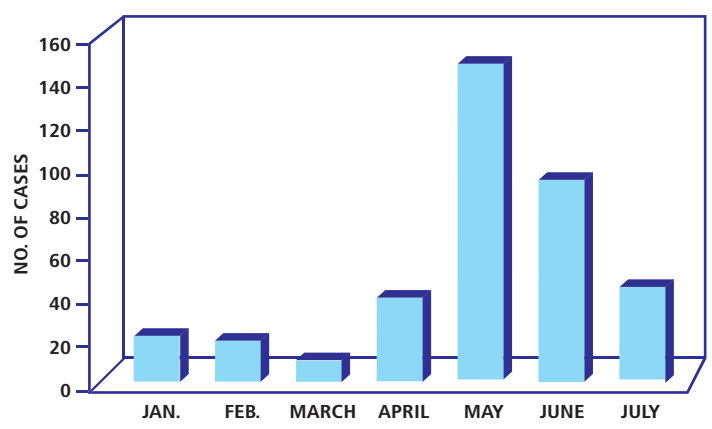
In 1994, measles activity in Canada has been characterized by sporadic cases, clusters of cases, or small outbreaks, often involving vaccinated individuals, or those not vaccinated for religious reasons. Despite these outbreaks and the potential for transmissions of the virus, the overall attack in the affected regions has still been low, suggesting that most individuals are immune. Examination of those records available indicated that, although most children were vaccinated after their first birthday, a few had received the vaccine before 12 months of age.

Acknowledgment

The assistance and cooperation of all provincial and territorial epidemiologists, medical officers of health and other health care personnel, as well as Ms. Carole Scott, Ms. Mary-Jane Garnett, and Mr. John Koch LCDC is greatly appreciated. By: Paul Varughese, Childhood Immunization Division, Bureau of Communicable Disease Epidemiology, LCDC, Ottawa

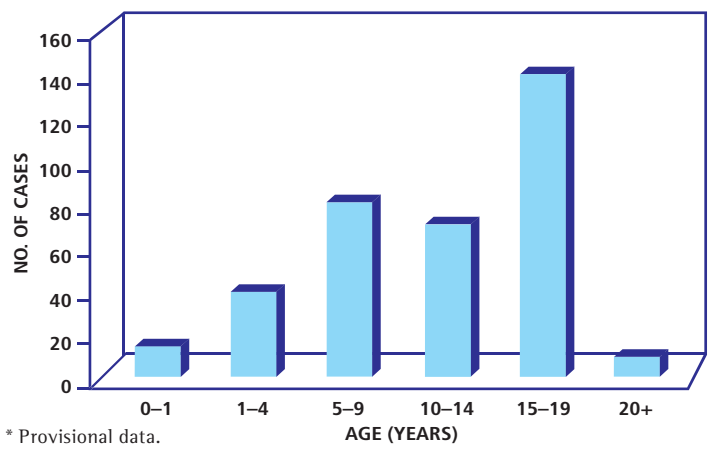
Source: Measles Update August/ September 1994; 2 (3): 5-6.

FIGURE 1 Reported cases of measles by month, Canada, January 1 to July 31, 1994.*



* Provisional data.

FIGURE 2 Reported cases of measles by age group, Canada, January 1 to July 31, 1994.*



* Provisional data.

December 1994
Volume XVI, Number 6

United Kingdom Launches National Measles Campaign

To prevent the occurrence of a predicted large measles epidemic in early 1995, health officials in the United Kingdom started a nationwide school-based vaccination campaign during the month of November 1994. The goal of this campaign is to provide measles, as well as rubella vaccine to all school children aged 5 to 16 years of age in the countries of the United Kingdom (England, Northern Ireland, Scotland, and Wales).

Without a measles vaccination campaign, mathematical models predicted that a large outbreak, with 100,000 to 200,000 measles cases, including up to 50 deaths would occur. The majority of cases were predicted to occur among school-aged children. Indeed, recent data suggests that approximately 14% of school-aged children may be susceptible to measles infection. Most of these susceptible children never received measles vaccine; a smaller percentage were vaccinated but, for a variety of reasons, did not become immune following vaccination. Conversely, vaccination coverage among children less than 5 years of age is over 90% and persons >15 years of age are likely to have had clinical measles disease following exposure to circulating measles virus and are thus immune.

The primary objective of the mass campaign is to rapidly interrupt measles virus transmission among school-aged children. If this campaign is subsequently linked to a strategy that prevents the re-accumulation of pools of susceptibles, then the elimination of measles becomes a realistic prospect.

After reviewing data regarding measles surveillance, vaccination coverage, age-specific seroepidemiology, as well as the mathematical models, the U.K. Joint Committee on Vaccination and Immunization has recommended that all school children 5 to 16 years of age, regardless of previous vaccination or disease history should be vaccinated 4ltt a school based campaign.

Health officials have decided to use measles-rubella (MR) vaccine for the campaign. Rubella vaccine was included in the campaign in order to quickly interrupt rubella transmission, which had recently been occurring among male older school-aged children and young adult males. However, there was little epidemiologic evidence to support the necessity for including the use of mumps vaccine during the campaign. Furthermore, there has been intense pressure worldwide on MMR vaccine supplies, and the Department of Health could not obtain sufficient vaccine in time to prevent the anticipated measles epidemic.

During the campaign, health officials are continuously monitoring vaccination uptake levels in all areas of the country. "Mop-up" vaccination activities will take place in areas with low vaccine coverage following the initial campaign. In addition, a special adverse event surveillance system has been established. Health practitioners have been asked to report all adverse events following vaccination in a timely manner. All adverse event reports will be investigated within 36 hours.

To monitor the impact of the vaccination campaign in reducing disease incidence, epidemiologic surveillance for cases of rubella and measles will be of great importance. However, the clinical diagnosis of both measles and rubella infections have proven to be quite unreliable, especially in young children. To improve the specificity of clinical diagnoses, the Public Health Laboratory Service has developed and tested a simple new laboratory test. This test uses the presence of measles and rubella specific IgM antibodies to confirm recent infection using a sample of saliva. The United Kingdom will be the first country in the world to use this new technique for measles and rubella surveillance.

Preliminary data as of 6 December 1994, suggest that high measles uptake is occurring throughout the country. An evaluation of the campaign is planned for early 1995.

Reported by: Dr. David Salisbury, Principal Medical Officer, Department of Health, London, England, United Kingdom 5.

Editorial Note:
The United Kingdom vaccination strategy is an adaptation of the measles elimination strategies recommended by PAHO and implemented by the countries of Latin America. Both include conducting national mass measles vaccination campaigns targeting susceptible children in order to quickly interrupt measles virus transmission.

The Latin American strategy has been to vaccinate all children 9 months to 14 years of age, regardless of previous measles vaccination or measles disease history. The epidemiologic situation in the United Kingdom, with a very high vaccination coverage level among preschool-aged children, made it very reasonable to adapt the strategy to an older age group, especially when supported by serological data on measles susceptibility by age.

A sensitive and timely measles surveillance system will help health authorities to carefully monitor the situation and to make quick adjustments in the strategy and to focus control activities on eliminating any remaining pockets of transmission. The new saliva IgM test should greatly facilitate the collection of samples for the laboratory confirmation of measles clinical diagnoses, requiring only 1 sample without blood sampling. Finally, the adverse event surveillance system will provide important epidemiologic information which should be especially useful not only for the UK, but also for health planners in other countries who are considering implementation of mass measles vaccination campaigns.

The vaccination campaign in the United Kingdom required intense efforts, careful coordination and strong collaboration between the health services and the education facilities. The successful implementation of this campaign will not only serve to make both measles and rubella memories in the United Kingdom, but will also serve as a strategic template for other industrialized countries with measles elimination goals.

December 1994
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Weekly Measles Bulletin is Launched

The EPI recently began producing a weekly measles bulletin in order to monitor the progress of measles elimination (targeted for the year 2000). The bulletin summarizes data provided from the enhanced fever and rash surveillance system being implemented in the countries of the Americas. The Rash and Fever Surveillance system facilitates the early detection and investigation of suspected measles cases, rapid enaction of control activities, and confirmation of the absence of suspected measles via negative reporting. A sensitive surveillance system such as this one is essential to any disease control and elimination program.

The PAHO Weekly Measles Bulletin will facilitate international communication concerning the regional measles situation. The bulletin is compiled by reviewing individual country reports and by summarizing sub-regional measles bulletins from Mexico, the English-speaking Caribbean and Central America. It is hoped that the information disseminated by this bulletin will increase measles awareness and promote cooperation in the eradication endeavor.

1995

February 1995
Volume XVII, Number 1

International Importations of Measles from the Americas into the United States, 1990–1994

Internationally imported cases of measles have been a well recognized problem in measles control in the United States.[1] This issue has been recently highlighted by the apparent interruption of indigenous transmission of measles in the United States in the fall of 1993 and presumed reintroduction by subsequent imported cases.[2,3]

Historically, countries of the Western Hemisphere have been the most common source for imported measles cases into the United States with Mexico being the leading source country. For the period of 1980-85, an average of 108 internationally imported cases were reported in the U.S. annually, with 19.7% of imported cases coming from Mexico and another 20.6% coming from other countries of the Americas. More recently, the period of 1990-94 has witnessed a progressive decline in both the absolute number and the percentage of imported cases coming from Mexico and other countries of the Americas (Table 1). In 1990, during a peak of measles activity throughout the Western Hemisphere, 178 (69.8%) of the 255 imported cases came from Mexico and 53 (20.8%) came from the other countries of the Americas. In contrast, only 2 (4%) of the 50 imported cases reported in 1994 came from Mexico and only 6 (12%) from other countries of the Americas. While the number of imported cases from other regions of the world has either remained steady or increased (see Figure 1), the near-elimination of imported cases from the Americas has resulted in a substantial decline in the total number of imported cases into the U.S.

The Pan American Health Organization's strategy for measles elimination, emphasizing national mass campaigns targeting all children within an age group for a dose of measles vaccine regardless of prior immunization status, has produced striking declines in reported measles cases throughout the Western Hemisphere. The success of this

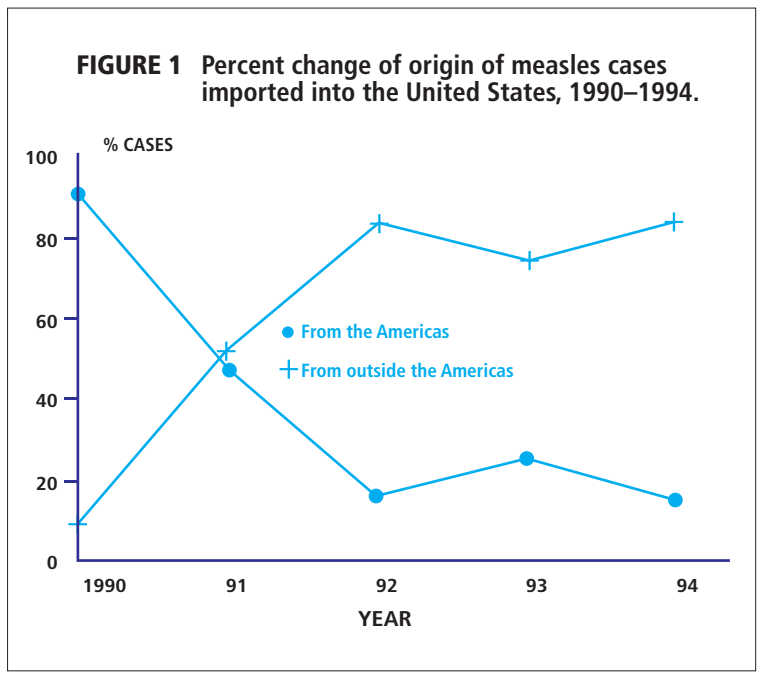

FIGURE 1 Percent change of origin of measles cases imported into the United States, 1990–1994.

TABLE 1 Table. 1 Measles cases imported to the U.S. by country of exposure, 1990-1994.

COUNTRY	1990	1991	1992	1993	1994
Argentina		1		1	
Bahamas		1			
Brazil	2				
Canada		6			1
Cayman Islands	3				
Colombia	2				
Cuba			1		
Dominican Rep.	2	4		3	2
Ecuador		1			2
El Salvador	1	1		1	
Guatemala	7				
Haiti	1	1		2	
Honduras		1			
Jamaica	6				
Mexico	178	12	1	1	2
Nicaragua	1				
Puerto Rico	25	1	2	2	1
Trinidad and Tobago	1				
Uruguay			1		
Venezuela	2		1	3	
Virgin Islands			1		
Total from the Americas: %	**231 (90.6%)**	**30 (47.6%)**	**7 (16.3%)**	**13 (25.5%)**	**8 (16.0%)**
Total imported	**255**	**63**	**43**	**51**	**50**

program is reflected in fewer imported measles cases reaching the United States, thereby facilitating measles elimination activities here. These results show that the benefits of improved international control of measles extend beyond national boundaries and that improved global control of measles is required to help all countries achieve and sustain measles elimination goals.

References

1 Markowitz LE. Tomasi A, Hawkins C. et at. International Measles Importations United States. 1980-1985. Int J of Epidemiol 1988;17: 187-92.

2 CDC. Absence of reported measles-United States. November 1993. MMWR 1993;42:925-6.

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February 1995
Volume XVII, Number 1

The National Measles Vaccination Campaign in Ecuador

A national vaccination campaign was carried out in Ecuador from August 1 to September 9, 1994 as part of the effort to eliminate measles from the Andean Region by 1998 and from the Americas by the year 2000. The objective was to vaccinate all children 9 months to 14 years of age, irrespective of their vaccination status or previous exposure to measles virus.

The campaign was organized in 3 phases:

The first one, from 1 to 12 August, consisted of the vaccination of all school children, in their respective institutions. Additionally, children 1 to 14 years of age attending any health institution were vaccinated. During this first phase 50% of the target population was expected to be covered.

The second phase, from 13 to 19 August, began with a National Vaccination Day, which was extended through the week to cover all children in the target age group who did not attend educational institutions and lived in densely populated areas. About 30% of the target population was expected to be covered during this phase.

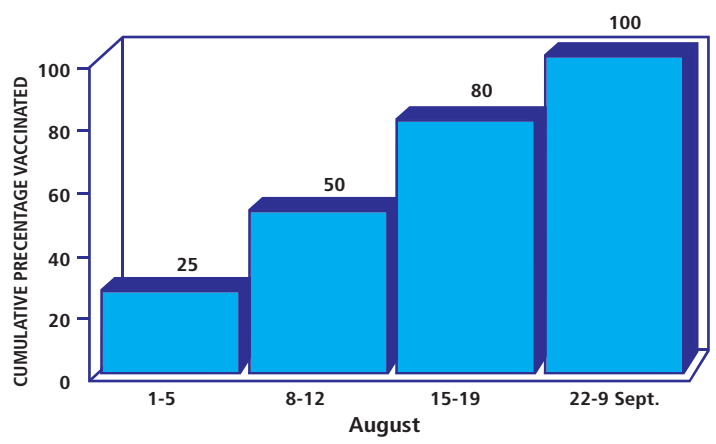
The third phase, from 22 August to 9 September, aimed to cover rural areas with sparse population.

During the six weeks of the campaign, 3,958,427 children less than 15 years of age were vaccinated, a number greater than the expected target of 3,950,441 children. (Figure 1)

The total cost of the campaign was estimated at US$ 2.5 million dollars. Apart from the national budget, PAHO, UNICEF and, for the first time, the World Bank (through its "FABASE" Project), contributed financially to the campaign. As shown in Figure 2, the impact of the vaccination on the reported incidence of measles was immediate.

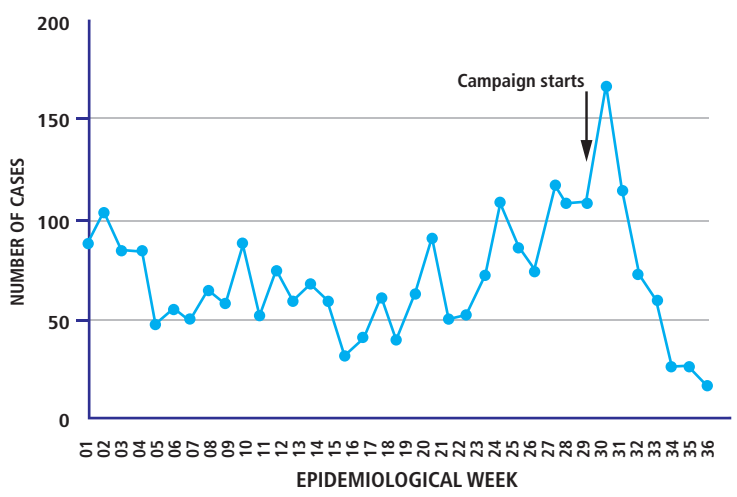
The next phase and challenge is to implement rash and fever surveillance to permit the timely detection of any measles cases and the organization of adequate control measures. Efforts will also be aimed at raising measles vaccine coverage to over 85% for each newborn cohort in order to minimize the build-up of susceptibles.

FIGURE 1 Percentage of children vaccinated in measles campaign by week, August to September 1994, Ecuador.



Source: Technical Committee, MOH, Ecuador.

FIGURE 2 Distribution of measles cases by week, Ecuador, 1994.*



* Data up to week 36. Total number of cases = 2,618.
Source: MInistry of Health.

First Lady, Mrs. Hillary Clinton announces USA support of Measles initiative during Word Health Day Ceremony.

April 1995
Volume XVII, Number 2

Measles Elimination: The Americas Receive Boost During World Health Day 1995

On April 7, 1995, under the auspices of the American Association for World Health (AAWH), the United States of America celebrated World Health Day, "A World Without Polio" at the Pan American Health Organization (PAHO) headquarters in Washington DC. Presiding over the festivities was Richard Wittenberg, President of the AAWH, along with the guest speakers Dr. George O. Alleyne, Director of PAHO; Dr. Marlene Kelly, Acting Commissioner of the Washington D.C. Commission for Public Health; and Dr. Jorvey Boufford, Principal Deputy Assistant Secretary for Heath at the U.S. Department of Health and Human Services. The keynote speaker was Mrs. Hillary Rodham Clinton, the First Lady of the United States.

Several awards were given to those people and organizations, both national and international, who played key roles in mobilizing diverse groups in the immunization effort. The national awards went to The All Kids Count Program, represented by Mr. William C. Watson, Deputy Director, for their work in developing innovative ways to reach those parents and children who fall behind their immunization schedules; the Group Health Association of America (GHAA), represented by Ms. Karen Ignagni, President and CEO of GHAA, for their Childhood Immunization Program which recruited 325 health maintenance organizations from across the U.S. in their efforts; Every Child By Two, represented by Mrs. Betty Bumpers, and founded by Mrs. Bumpers and the former First Lady Mrs. Rosalyn Carter, who formed a network of influential women to raise awareness both locally and nationally to influence policies about immunization systems; and to Dr. Walter A. Orenstein, Director of the National Immunization Program of the Center for Disease Control and Prevention, who has helped make resources available for improving the immunization status of American children. The recipients of the international awards were Mr. Gustavo Gross, president of the PolioPlus Committee for Peru, who won the 1995 Macedo Award for his work in mobilizing political will and resources at the national level among Rotarians and the political leaders throughout the Americas in support of polio eradication efforts; and the National Vaccination Council of Mexico (CONAVA), represented by Dr. Rafael Alvarez Cordero, General Director of International Affairs of the Ministry of Health of Mexico, received the Alleyne Award for their contribution to the eradication of polio in Mexico. The final award was presented to Mrs. Clinton, and was inscribed "To Hillary Rodham Clinton, First Lady, in recognition of her many years of dedicated concern for the health, education and sustained well-being of children."

Mrs. Clinton, along with the other speakers, congratulated the efforts made by all those who participated in the campaign against polio, and helped to realize the goal of eradicating polio in the Americas. The elimination of polio in the Region came as the result of a concerted effort on the part of health care workers, governments, and non-governmental organizations, who succeeded in forming a partnership for mobilizing large sectors of their societies. As a result, people were not only educated as to the benefits of immunizing their chi1dren, but also access to immunization was facilitated by the health care workers who went directly to the target population, especially during National Immunization Days and the house-to-house "mop-up" operations. Mrs. Clinton said, "All of you here should take pride in that achievement.... Now the work must continue in other parts of the world and in our region we must turn our attention to another major health threat to children: measles."

Mrs. Clinton stated that at the Summit of the Americas held last December (1994), commitments were made to provide both opportunities and justice for all children. Government leaders endorsed the goal of making basic health services available to all citizens. In reference to a symposium held by the first ladies of the Region during the Summit, Mrs. Clinton said "Today these women across the Americas are turning rhetoric into reality by helping launch PAHO's historic campaign to eliminate measles from our hemisphere by the year 2000....The campaign to eliminate measles is vital to all of our futures. It will save the lives of countless children in every country and will bring primary health care to every single village in our hemisphere.... The important aspects of PAHO's campaign to eliminate measles is that it will advance all of our immunization efforts and carries forward the Summit of the Americas plan of action."

As part of launching the Measles Elimination Effort, Mrs. Clinton said that through the United States Agency for International Development (USAID), the United States will join in partnership with PAHO for this campaign by contributing US$ 8 million directly to PAHO's Expanded Program on Immunization. She stated, "While ushering children into the world is the province of families, protecting them from avoidable diseases must be viewed as the shared responsibility of our larger human family. ... That is why it is our responsibility as a community of nations to insist that all children receive the health care they need."

June 1995
Volume XVII, Number 3

Southern Cone: Measles Elimination

The tenth meeting of the "Asuncion Group" was held in Santiago, Chile, from 18 to 20 April 1995, and included representatives of the countries of the Southern Cone, Brazil and Cuba. This meeting comes after the Symposium on Children, part of the Summit of the Americas held in December 1994 in Miami, where the First Ladies of the Region made the commitment to support the campaign for measles elimination in the Americas. The focus of the two conferences was on evaluating the progress made in the countries toward the goal to eliminate measles by the year 2000, which was set by the Pan American Sanitary Conference in 1994. In Chile the following subjects were also discussed:

- Maintaining the surveillance levels for acute flaccid paralysis necessary for the Region to continue free of poliomyelitis,
- Measures for the control) of neonatal tetanus, and
- Use of the vaccines against hepatitis B and *Haemophilus influenzae* type b.

The following is a summary of the discussions and conclusions reached in the meeting in regards to measles.

Measles Elimination by the Year 2000

The impact of national vaccination campaigns can be seen in Table l, which shows the decrease in number of confirmed cases of measles. Brazil and Chile conducted vaccination campaigns in 1992. Argentina in 1993, and Uruguay in 1994. More than 95% of the population between l - 14 years of age were vaccinated in these countries. Paraguay is organizing a national vaccination campaign for this year. and Brazil will conduct a follow-up campaign to reach children between the ages of one and three who were not vaccinated in the 1992 campaign.

Argentina, Brazil, and Chile have set up surveillance systems for rash and fever illnesses (RFIs) together with networks of laboratories to support diagnosis of these cases. In Brazil, 70% of cases were confirmed by laboratory testing. Paraguay and Uruguay have not yet intensified their epidemiological surveillance activities for RFIs.

To facilitate the surveillance of RFIs, the definition of a "probable case of measles" was changed in October 1994 to include cases in which there is fever for at least two days. This will help increase the number of cases that enter the surveillance system. The importance of participation by the private sector in RFI surveillance was underscored during the presentation of the country reports.

Conclusions and Recommendations

The countries that have launched measles elimination programs must maintain high vaccination coverage in each cohort of infants less than one year old. The coverage rates should be periodically examined not only at the national level, but also at the state or municipal level.

Every country, upon initiating a national measles vaccination campaign, must maintain both a surveillance system capable of detecting all cases of RFIs and the ability to carry out the control measures recommended in the PAHO Measles Elimination Field Guide. Immediate notification of suspected cases of measles should be instituted.

Brazil should look for ways to properly monitor surveillance of RFIs at the national level and to coordinate surveillance and control operations between border states and the adjacent countries.

Countries should use a definition of a "probable measles case" which is sensitive enough to avoid possible surveillance errors that could prevent the prompt detection of outbreaks. This could, in turn, endanger the progress made during national vaccination campaigns. In addition, it is important to involve the private sector in the notification of RFIs. The universities can play an important part in training the health personnel employed in the public and private health sectors.

Upon the occurrence of a probable measles case immediate steps should be taken to determine whether it is the result of any of the following system flaws: the patient's vaccination history, his or her place of origin, the possibility of the patient's having visited other areas of possible transmission, and to identify the vaccination status of the populations exposed to the risk of an outbreak. In the event that vaccination measures are required (e.g. if the coverage has been less than 95%), the decision on which geographic area and which age group to vaccinate will be based upon the analysis of the local epidemiological information.

The countries should document measles outbreaks and examine their epidemiological variables. Adjustments to elimination strategies can be made based upon the information collected. Also, when suspected cases occur in border areas, the neighboring countries must be notified so that joint surveillance operations may be launched. PAHO can facilitate these exchanges of information.

Paraguay should carry out a national vaccination campaign for children between the ages of l and 14 as soon as possible. Therefore, progress towards the control and elimination of measles will be at similar levels throughout the Southern Cone.

It is apparent that in the countries which have conducted vaccination campaigns targeting children between the ages of 9 months and 14 years, even in those still using 2-dose vaccination schedule, a population of susceptibles is growing, which could eventually lead to an outbreak of measles. This buildup is expected because the efficacy of the vaccine is not 100%, and even in the best programs the coverage rates can fall short of 100%. The rate of accumulation of susceptibles varies with the levels of coverage attained in the different countries.

Therefore, it is necessary to carry out periodic vaccination campaigns in those age groups determined by the variables of coverage and immunity over time. In general, it is recommended that a campaign be conducted when the number of accumulated susceptibles amounts to a cohort of live births. In a country that maintains vaccination coverage rates of 90% among infants under one year of age this number of susceptibles will be reached in six years. In such case, a campaign must be carried out at 5-year intervals among the population aged one to five years regardless of previous vaccination status. This holds true even in countries that administer the 2-dose measles vaccine in their routine program.

The following indicators should be the minimum required for the evaluation of RFI surveillance, however they are not yet being used in the countries:

- % of weekly negative notification
- % of cases with complete epidemiological records
- % of cases with adequate response and documented investigation
- % of notified cases that meet the definition of "probable case"
- % of cases with proper serum samples

Data should be collected in a uniform manner through the Regional Measles Elimination Surveillance System (MESS) so that epidemiological analysis can be standardized at the national and hemispheric levels.

The lack of a laboratory test that is sufficiently sensitive and specific constitutes a major obstacle for surveillance. The diagnostic techniques used in the different countries must be standardized as soon as possible as a provisional measure until a simple, rapid test for immediate diagnosis in the field is available. PAHO will promote a meeting of virologists in May 1995 to consider this matter.

The First Ladies should be kept informed by the Ministers of Health of their respective countries as to the progress of the program in order to facilitate the support they may be able to give to the measles elimination program.

TABLE 1. Confirmed cases of measles, Souhern Cone and Brazil, 1992–1994.*

Country	Number of confirmed cases of measles								
	1992			1993			1994		
	Notified	Com-patibles	Con-firmed	Notified	Com-patibles	Con-firmed	Notified	Com-patibles	Con-firmed
Argentina	20,551	-	20,551	5,048	-	5,048	1,160	612	134
Brazil	7,934	-	209	6,251	1,932	273	2,269	381	38
Chile	777	62	1*	283	23	1	210	13	0
Paraguay	864	-	864	2,066	-	2,066	142	20	122
Uruguay	187	-	187	16	-	16	12	-	12
Total	30,313	62	21,812	13,664	1,955	7,404	3,793	1,026	306

* Following Campaign of April 1992.

June 1995
Volume XVII, Number 3

Measles In Canada, 1994-1995 (as of February 14)

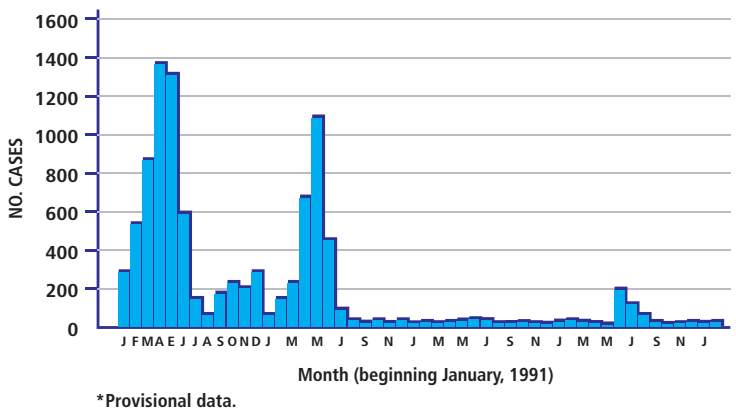
From January 1 to December 31, 1994, a provisional total of 518 measles cases (1.80 per 100,000 population) was reported in Canada. This is 2.5 times greater than the total of 204 cases reported for 1993, but substantially lower than those reported for 1991 (6,178) and 1992 (3,011). The lowest annual number of cases ever recorded in Canada was in 1993. Figure 1 shows the trend in reported incidence, by month, from January 1991 to January 1995. During the past four years, the lowest measles activity (three cases) was reported in December 1994. In 1995, as of January 31, a total of nine cases has been reported.

TABLE 1. Reported cases of measles, Canada, 1994.

Providence/Territory	(Preliminary data) No. of cases	%	Rate /100.000 population
Newfoundland	5	1	0.9
Prince Edward Island	0	0	0
Nova Scotia	1	0.2	0.1
New Brunswick	1	0.2	0.1
Quebec	128	24.7	1.8
Ontario	219	61.4	3
Manitoba	1	0.2	0.1
Saskatchewan	4	0.8	0.4
Alberta	31	6	1.2
British Columbia	38	5.4	0.8
Yuko	0	0	0
Northewest Territories	0	0	0
Canada	518	100	1.8

Source: Paul Varughese. Childhood Immunization Division, Bureau of Communicable Disease Epidemiology, LCDC, Ottawa. Measles Update [995;3(1)1-2.

FIGURE 1 Reported cases of measles by month, Canada, 1991–1995 (January).*



*Provisional data.

Editorial Note:

The reported measles activity across Canada in recent months suggests that the virus is confined to a specific geographic area in Ontario. However, the possibility of introducing the virus to other communities within or outside this province is feasible because of population mobility and other common activities.

Constant surveillance and timely reporting at all levels of government is essential to achieve measles elimination.

In view of the low measles incidence in Canada, it is important that each case receives specific attention and a thorough epidemiologic investigation.

In order to comply with the PAHO/WHO request for weekly notification, and as outlined in the Measles Consensus Conference, we are seeking your assistance in the timely reporting of all unusual incidents or outbreaks of measles, including epidemiologically linked clinical cases, to your provincial/territorial health authorities for subsequent notification to the Childhood Immunization Division, LCDC (Tel: 613-957-1344 or Fax: 613-998-6413).

We also welcome photographs of clinical presentation, including a brief note, for inclusion in upcoming issues of Measles Update.

Acknowledgement: The assistance and cooperation of all provincial and territorial epidemiologists, medical officers of health and other health care personnel, and staff from LCDC, is greatly appreciated.

Table 1 shows the distribution of cases by province and territory for 1994. Ontario accounted for 61.6% (319 cases or 2.97 per 100,000 population) of the total, followed by Quebec with 24.7% (128 cases or 1.77 per 100,000). Nine of the 10 provinces reported measles, and the number of cases ranged from one each in Manitoba, New Brunswick and Nova Scotia to 319 cases in Ontario. No cases were reported from Prince Edward Island, the Yukon and the Northwest Territories.

In 1994, a total of four outbreaks were reported in Canada: two in Ontario and two in Quebec. The outbreaks in Ontario peaked in May, while both the outbreaks in Quebec peaked in June and July. Brief descriptions of these outbreaks were published in previous issues of Measles Update.

Approximately 25% of the 1994 cases have been serologically confirmed.

In general, the epidemiologic characteristics, i.e., the age distribution, preventability status, immunization status, etc., of measles cases reported in this issue remain the same as those presented in the previous issue.

During January 1995, a small outbreak involving eight cases was reported from the Peel Regional Health Unit in Ontario. All of the cases were students from one secondary school and had a history of receiving measles vaccine after the first birthday. Five of these cases were laboratory confirmed for IgM; the other cases were clinically diagnosed. With the exception of one clinical case from another health region in Ontario, no additional cases have been reported to date from other provinces or territories.

June 1995
Volume XVII, Number 3

Update: Measles Elimination in England

As reported in the December 1994 issue of the EPI Newsletter (Vol. XVI, No.6), the United Kingdom launched a national measles campaign in November 1994. Mathematical models constructed by two independent groups, combined with the fact that measles notifications in 1994 were rising (Figure 1) predicted an epidemic of measles which could cause an estimated 150,000 cases with up to 50 deaths.

Laboratory confirmation of measles showed that the distribution of cases was shifting to older groups. Figure 2 provides an estimate of probability that notified cases were correctly diagnosed. When this probability was applied to the notified cases according to their age, it could be seen that the group at highest risk of measles was not the group from whom most notifications were coming (1-9 years), but older children (10-14 years, Figure 3).

The Joint Committee on Vaccination and Immunization (JCVI) recommended that a nation-wide school based immunization campaign should be carried out using the MR vaccine. The target population, all school children aged 5 to 16, was chosen on the basis of age specific seroepidemiology that identified that this was the group that would benefit most from immunization. It also matched well the planned immunization of school children up to 6th grade.

The results of cost benefit analyses showed that the most effective use of resources was to implement an intensive school health service delivered campaign targeted at all children aged 5 to 16 years, irrespective of previous history of measles or immunization. The cost of the campaign (vaccine, publicity, and operational costs) was estimated at £20 million---one third of the estimated cost of an epidemic.

Publicity for the campaign began in October, 1994, with national advertisements about the benefits of the campaign and reminders to parents to complete the consent forms distributed through the schools. Around 12 million doses of vaccine were issued in advance of the campaign with every district appropriately resourced for vaccine and consumables (syringes, needles, sharp boxes). Most Health Authorities ran their campaigns during November with mop-up activities in December. In some cases, the campaign ran through December with mopping-up being completed by early February, 1995.

FIGURE 1 Measles notifications in England & Wales, 1988 to 1994 (OPCS data).

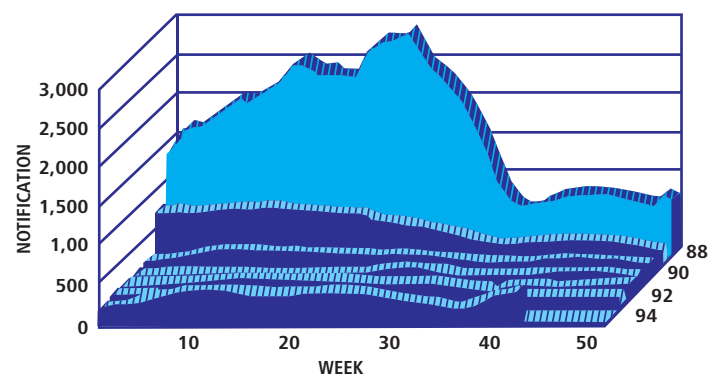


FIGURE 2 Proportion of notified measles cases confirmed by laboratory testing (PHLS data).

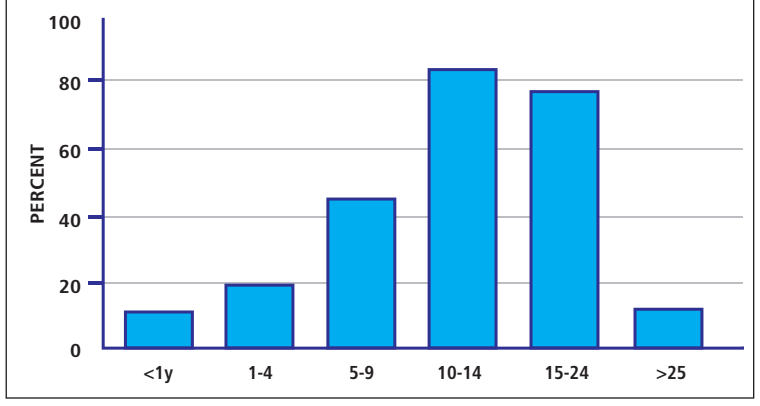


FIGURE 3 Left: Age specific notifications of measles England & Wales, 1993–1994, not corrected. Right: As left, corrected for probability of correct diagnosis for each age band (as in Fig. 2).

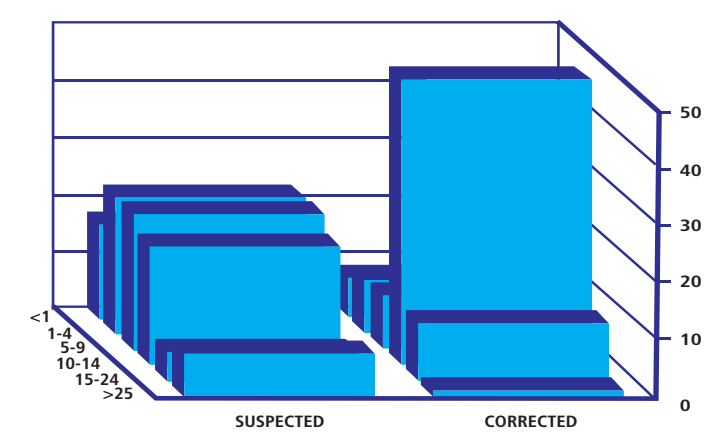


FIGURE 4 Measles notifications England & Wales, 1987 and 1994 (OPCS reports).

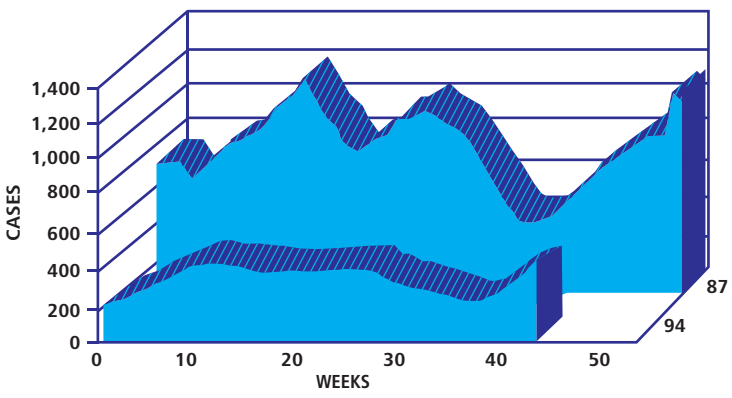
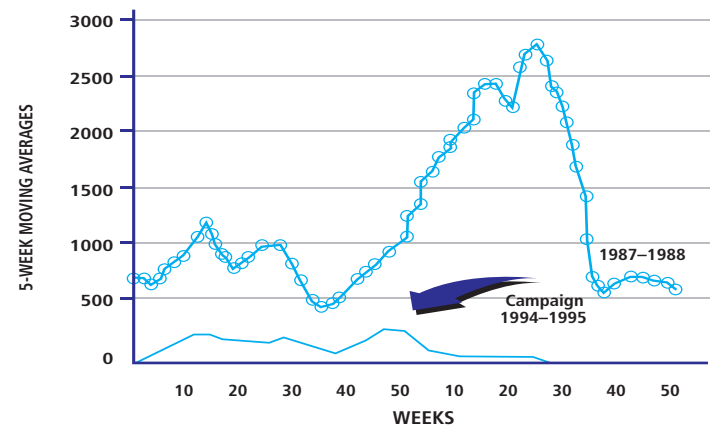


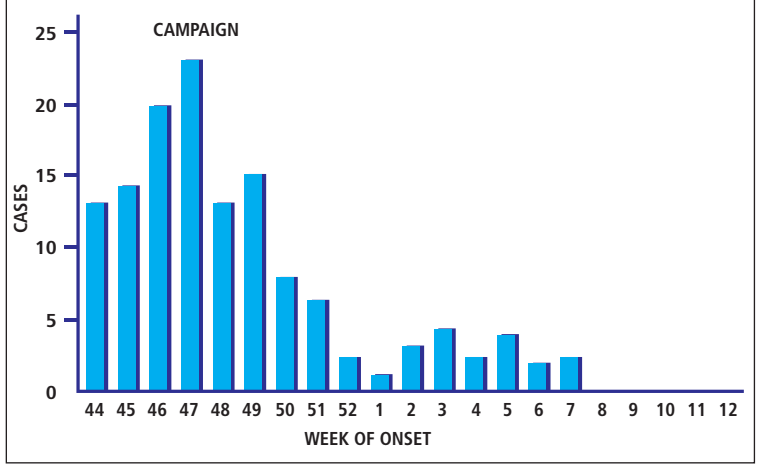
FIGURE 5 Measles notifications, England and Wales, 1987-88 and 1994–95 (OPCS reports).



Campaign Results

The target population for England was 7.1 million children. The first information return from Districts reported on the number of children immunized during November alone. The national coverage was around 90%. Districts and NHS Trusts have now submitted their final returns

FIGURE 6 Cases of measles, England and Wales, confirmed by salivary antibody testing. (PHLS data).



for the November phase of the campaign and the mop-up activities. 92% of 7.1 million children, whose ages ranged from 5 to 16 years, have been immunized in England.

In 1994, notifications of measles had been rising in line with those seen in 1987, the lead-in phase to the 1988 measles epidemic. In 1988, the last epidemic year, there were 86,000 notifications and 15 deaths (Figure 4).

The predictions for 1995 had suggested an epidemic of the order of 150,000 cases. Because more cases would occur in older individuals than previously and measles case fatality rates increase with advancing age, approximately 50 deaths were anticipated.

Previous experience has demonstrated that measles notification data shows useful trends but individual notifications are highly unreliable, especially in younger children; here the specificity of notification in the under 5s is considerably less than 20%. Since the beginning of November 1994, the Public Health Laboratory Service has been able to use salivary antibody diagnosis to confirm measles in suspected cases (Figures 5 and 6). There were more than 100 positive reports in November and December 1994. In 1995, despite more than 800 samplings having been tested, there have been only 21 confirmed measles cases. Only one case occurred in a child whose age was covered by the campaign; that child's parents had withheld consent. All other cases were in children under the age of routine immunization, those under 5 years who had received one dose of MMR vaccine previously, or who were over 17 years.

Since 24 February 1995, there have been no confirmed cases of indigenous measles in England, Wales and Northern Ireland.

Sourc: Dr. D. M. Salisbury MD FRCP MFPIIM. Principal Medical Officer, Department of Health, London, United Kingdom.

August 1995
Volume XVII, Number 4

PAHO Measles Laboratory Network Workshop

From the 22 to 26 of May, 1995 PAHO and the Centers for Disease Control and Prevention (CDC), USA, coordinated a measles diagnostic workshop in Atlanta. The purpose of this workshop was twofold: to update representatives of the participating reference laboratories on the current status of procedures for laboratory confirmation of suspected measles cases and to establish guidelines and procedures for the PAHO Measles Laboratory Network.

In September 1994, at the meeting of the Pan American Sanitary Conference, the Ministers of Health of the countries of the Americas unanimously adopted the goal of measles elimination in the Americas by the year 2000. The PAHO measles elimination strategy includes the following components:

- Achieving and maintaining high vaccination coverage in the population from 9 months to 14 years old.
- Careful surveillance for fever and rash illnesses.
- Laboratory testing of sera collected from patients with fever and rash illnesses in whom a health care provider suspects measles infection.

Recognizing the importance of laboratory confirmation of suspected measles cases, the Pan American Health Organization has begun establishing a region-wide measles laboratory network. PAHO has requested that the twelve national measles laboratories from member countries participate in the PAHO measles laboratory network (Table 1 and Figure 1).

Update on Measles Diagnostics

The current "gold standard" for the serologic confirmation of measles diagnoses is the capture IgM immunoassay, using a recombinant measles virus nucleoprotein as antigen. Commercially available indirect IgM assays appear to perform satisfactorily for determining the presence or absence of IgM in most specimens, but are clearly less sensitive and specific than the CDC capture immunoassay.

Work is progressing towards the development of a rapid measles diagnostic test which can be used at the field level. It is hoped that a simple agglutination test can be developed using genetically engineered antigens containing measles virus epitopes.

Measles virus can be isolated from urinary tract cells and throat and nasal passage cells. The Marmoset lymphocyte continuous line B95A has been used with success for measles virus isolation.

Polymerase chain reaction (PCR) has been shown to be effective in detecting measles RNA and this technique can be used as a complement to serologic tests to confirm measles diagnoses.

The CDC has developed expertise in performing genotypic analysis of measles virus isolates obtained from various outbreaks. These analyses have proven useful in determining likely geographic sources of measles virus.

Conclusions

The development of a region-wide measles laboratory network will greatly help in monitoring progress made towards measles elimination. With assistance from the laboratory network and clinicians, public health workers will be able confirm or exclude measles circulation within a community in a timely manner.

A functional structure of the measles laboratory network was proposed (Table 1). The participating reference laboratories will assist and support neighboring countries in establishing national measles laboratories.

TABLE 1. PAHO measles laboratory network.

Participating reference laboratory	Countries Supported
Laboratorio de Diagnóstico e Investigación, Argentina	Argentina Paraguay Uruguay
Fundacao Oswaldo Cruz, Brazil Instituto Adolfo Lutz, Brazil	Brazil
To be determined	Canada
Instituto de Salud Pública, Chile	Bolivia Chile Peru
Instituto Nacional de Salud (INS), Colombia	Colombia Ecuador
Instituto Pedro Kouri (IPK), Cuba	Cuba Dominican Republic Haiti
Centro Conmemorativo Grogas, Panama	Central America
Caribbean Epidemiological Center (CAREC), Trinidad and Tobago	Belize English-speaking Caribbean Suriname
Instituto Nacional de Diagnóstico y Referencia Epidemiológica (INDRE), Mexico	Mexico
Centers for Disease Control and Prevention (CDC), Atlanta, Georgia	USA
Instituto Nacional de Higiene (INH), Venezuela	Venezuela

FIGURE 1 PAHO measles laboratory network.

Each national laboratory will be expected to test serum specimens for anti-measles IgM using a commercial kit via the indirect method. The national laboratories will send all positive and indeterminate serum samples to the reference laboratories for confirmation. In addition, a random sample of 5-10% of negative specimens should be sent as well.

The CDC will send out panels of 10-15 sera for proficiency testing to participating reference laboratories approximately every 6 months.

Ongoing communication between participating reference laboratories is very important. The preferred method of communication will be electronic mail. Therefore, efforts will be made to assure that all laboratories have Internet access.

With regards to surveillance issues, the following points were agreed upon:

- Serum specimens should be collected only from patients meeting the clinical case definition for measles or from any patient in whom there is a clinical suspicion of measles infection.
- A single serum specimen collected 3 to 28 days following rash onset is considered acceptable and sufficient for IgM testing via capture method. The serum specimen should generally be obtained when the patient presents to a health facility. If a serum specimen is collected earlier than 3 days following rash onset, a second specimen should be collected 10-20 days following the acute specimen.
- During an outbreak, efforts should be made to obtain urine and/or nasopharyngeal aspirate specimens for viral isolation from several patients with measles. The optimal time for collecting urine specimens is within 7 days of rash onset. Urine specimens should be spun down and frozen. If the case is serologically confirmed as measles, the urine sample should be sent to the appropriate participating reference laboratory for viral isolation.
- Each specimen presented for testing to a participating laboratory must contain the following minimal information:
  Name of institution/ provider sending specimen
  Patient ID
  Patient name
  City, County (municipality)

Age
Sex
Meets "probable" case definition?
Number of doses of measles vaccine received
Date last measles vaccination
Date of rash onset
Date of collection

If this information is not provided, the laboratory may reject the specimen.

October 1995
Volume XVII, Number 5

Progress of EPI Programs Reviewed in Central American and Andean Regions

The annual meetings of the EPI Managers of the Andean and Central American regions were held in Caracas, Venezuela and Guatemala City, Guatemala, respectively during the month of August, 1995. Participants included representatives of the Ministries of Health, UNICEF, USAID, PAHO/WHO, Project Hope, Rotary International and the Embassy of Japan. Also attending were representatives of the Latin Caribbean and Mexico.

High on the agenda at both meetings was the presentation of progress reports on the national efforts to eliminate the transmission of measles. The general assessment was that while the current immunization efforts have sharply reduced the incidence of the disease, the number of accumulated susceptibles continues to present a risk of new outbreaks in the short and medium terms. As a result, Central American countries are planning measles vaccination campaigns for children less than 5 years of age before March 1996. As can be seen in Table 1, overall coverage rates remained at high levels, also for other EPI antigens.

Following the resolution calling for the elimination of measles transmission in the Western Hemisphere by the year 2000, adopted in September of 1994, these regional meetings are paying closer attention to reviewing and evaluating the overall progress of the measles elimination efforts in the Region.

Measles Surveillance

Since 1994 the countries of the Andean and Central American regions have been implementing surveillance systems for fever and rash illnesses for measles elimination. In general, these systems are at various stages of development. Among the major problems are the lack of standardization of case classifications and surveillance indicators, as well as a lack of adequate laboratory support, especially in Bolivia, Ecuador and Peru.

Currently, efforts are being made to strengthen the operational capacity of laboratories to enhance the diagnosis of measles. In Central America, only six of the nine countries attending the regional meeting have begun to implement laboratory diagnosis of measles utilizing recommended reagents for carrying out laboratory assays.

Recommendations

The following measles surveillance indicators were recommended as minimum requirements:

- Percentage of units that fulfill weekly negative notification.
- Percentage of cases investigated within 48 hours of notification.
- Percentage of cases with completed investigation forms.
- Percentage of cases with adequate serum samples taken.
- Percentage of laboratory confirmed cases.
- Percentage of cases (or outbreaks) with an identified source of infection.

Other recommendations indicated that countries should:

- Maintain >95% vaccination coverage of children less than 1 year old in all municipalities of every country.
- Monitor periodically the accumulation of susceptibles, and carry out vaccination campaigns to prevent outbreaks when this number is equal to a cohort of newborns.
- Change the recommended age for primary measles vaccination from 9 months to 12 months of age.
- Expand the network of measles reporting units.
- Strengthen the utilization of the Measles Elimination Surveillance System (MESS) in the countries, as a database for surveillance.
- Focus epidemiological surveillance on cases that fit the definition of suspected measles case. The surveillance system will follow-up on those cases or outbreaks that merit a blood sample taken for laboratory confirmation. Reported cases of measles without laboratory diagnosis will be considered clinically confirmed.

The Regional Measles Laboratory Network is being strengthened. Central American countries will ship serum samples from positive and suspected measles cases, as well as from 5-10% of negative cases to the national laboratory belonging to the Network (*Centro Conmemorativo Gorgas* in Panama). The Andean countries have implemented laboratory diagnosis in Bolivia, Ecuador and Peru, and have also strengthened the laboratory networks in Colombia and Venezuela.

TABLE 1. Coverage rates for children <1 year old, Central America, Andean Region, Latin Caribbean, and Mexico, 1994-1995.*

Country	OPV3		DPT 3		Measles		BCG	
	1994	1995	1994	1995	1994	1995	1994	1995
Belize	83	n/a	88	n/a	82	n/a	89	n/a
Bolivia	82	84	78	84	89	80	90	90
Colombia	92	82	88	81	83	76	96	91
Costa Rica	87	84	87	85	89	78	93	n/a
Dominican Republic	98	87	83	83	87	96	64	74
Ecuador	78	80	80	80	100	76	100	100
El Salvador	89	96	89	96	83	88	82	84
Guatemala	73	74	71	72	66	66	70	78
Haiti	27	n/a	28	n/a	25	96**	39	n/a
Honduras	95	96	96	98	95	96	95	96
Mexico	92	89	91	89	90	86	97	97
Nicaragua	84	92	74	82	73	78	81	100
Panama	83	88	83	90	84	84	95	94
Peru	87	86	87	86	75	62	92	92
Venezuela	73	84	63	67	94	70	95	98

* Coverage rates are estimated for the first half of 1995.
** Haiti carried out a mass campaign for measles for children 9 months to 14 years of age.
n/a: Data not available.

October 1995
Volume XVII, Number 5

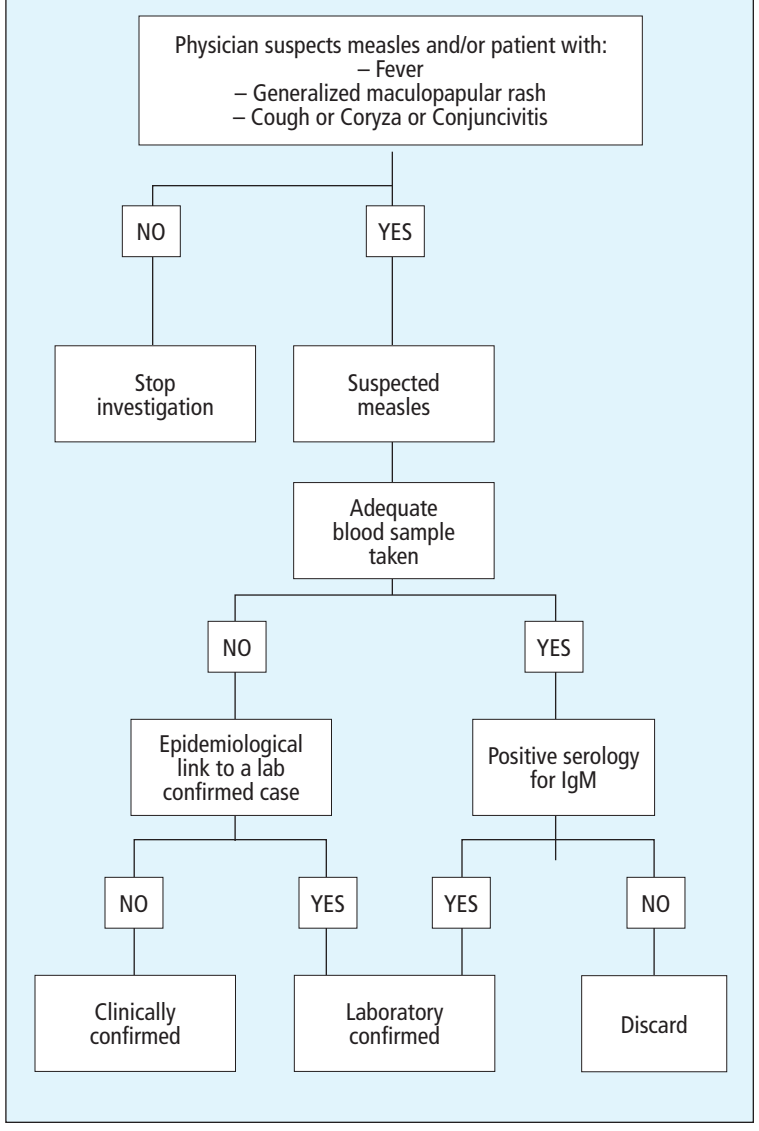
Revised Measles Case Classifications

An informal consultation group met at the Pan American Health Organization's headquarters in Washington, D.C., on September 11-13, 1995, to review current measles surveillance procedures and to recommend case definitions and case investigation procedures. The revisions are aimed at simplifying case investigations and case classifications, as well as to strengthen current national and regional surveillance efforts towards the elimination of measles from the Americas by the year 2000.

The overall purpose of measles surveillance is to promptly detect the transmission of measles virus in a given area. Once viral circulation has been detected, the surveillance system allows for the efficient investigation of the resulting measles cases. Through the timely investigation of an outbreak, further virus transmission can be minimized, causative factors for measles transmission can be determined, and the source of the measles introduction may be identified.

The measles elimination program focuses on detecting all cases for which a clinician suspects measles and/or those cases notified by any person which satisfy the clinical case definition of a suspected measles case, that is fever, generalized maculopapular rash, and cough, or coryza, or conjunctivitis. Suspected measles cases must then be classified as either confirmed or discarded. The program seeks to achieve laboratory confirmation (or epidemiological linkage to a laboratory confirmed case) for all suspected cases. However, until the PAHO measles laboratory network is fully functional, cases that meet the suspected case definition, but are not investigated in the laboratory or lack an epidemiologic link, are considered as clinically confirmed. It is expected that as the surveillance system matures, relatively few cases will be classified as clinically confirmed.

Flowchart for measles case classifications



The category of suspected measles is a broad catchment which is intended to provide an early alert or warning sign for health workers at the lowest level. Investigation of suspected measles cases should begin within 48 hours of notification. Once the epidemiologic investigation has been completed, a final classification should be made within 4 weeks.

Revised Measles Surveillance Case Classifications

I. Suspected measles case:

A. Any patient in whom a clinician suspects measles, and/or
B. A patient with the following clinical profile:
   – Fever
   – Generalized maculopapular rash, and
   – At least one of the following: Cough or Coryza, or Conjunctivitis

II. Confirmed measles case:

A. Laboratory confirmed case is a suspected case with 1 or more of the following:
   1. Laboratory confirmation, and/or
   2. Epidemiologic linkage to another laboratory confirmed case

   A case is laboratory confirmed if anti-measles IgM antibodies are detected in a blood sample obtained 3-28 days following rash onset. One adequate blood sample is considered sufficient for measles confirmation. In an outbreak of more than 10 cases, it is not necessary to take blood samples from every suspected measles case. Only the first 3 to 5 cases should have blood drawn for laboratory confirmation. Other cases can be confirmed if they meet the suspected case definition and are epidemiologically linked to another laboratory confirmed case. Epidemiologic confirmation takes place when a suspected measles case has been in contact with a laboratory confirmed case, who had rash onset within 21 days before the present case.

B. Clinically confirmed measles case
   These cases satisfy the definition of a suspected measles case, but lack laboratory investigation and it is not known whether or not there was contact with a laboratory confirmed case. Although the final diagnosis is not known, for surveillance purposes, these cases are considered as clinically confirmed measles. Given an adequate surveillance system, suspected cases with incomplete investigations should become relatively

rare. These cases are considered failures ofthe surveillance system.

III. Discarded (Not measles)
If laboratory evidence is obtained that another infection associated with a rash illness was present, then the case is discarded. A case is also discarded if the result of an adequate laboratory specimen, collected between 3 and 28 days following rash onset, is negative for measles infection.

October 1995
Volume XVII, Number 5

Plan To Eliminate Measles Approved

During the XXXVIII Meeting of the Directing Council of the Pan American Health Organization held in September 25-30, in Washington, D.C., the Ministries of Health of the Region of the Americas unanimously approved the Measles Elimination Plan of Action prepared by PAHO's Special Program for Vaccines and Immunization in conjunction with the Organization's Member Countries.

The plan calls for the achievement and maintenance of 95% measles vaccine coverage in all municipalities or districts in every country of the Region, with complementary periodic vaccination campaigns aimed at preventing the accumulation of susceptibles among pre-school children. It will have a duration of five years (1996 - 2000) and will cost approximately US$ 53 million, which includes the provision of an estimated $ 7 million from PAHO and WHO regular budgets and voluntary funds. These investments will complement national resources. Major emphasis is being placed on training personnel for effective program operations; a careful fever and rash surveillance for the detection of possible measles cases; an aggressive outbreak response; and intensive social mobilization to enhance the community's role in the prevention ofthe disease.

The Resolution noted that:

Having reviewed and discussed Document CD38/15, containing the Plan of Action and a progress report on the national and regional efforts towards the elimination of measles from the Americas by the year 2000;

Noting with satisfaction that nearly all countries have adopted the strategies outlined in the Plan of Action and have made considerable progress towards measles elimination;

Observing that, in spite of the major efforts made with the implementation of national campaigns and improvements in routine vaccination programs, the number of susceptible children is accumulating every year in every country;

Realizing that measles surveillance requires considerable resources, both financial and human, but cognizant that a surveillance system is essential to future developments of communicable disease surveillance, including emerging and re-emerging infections; and

Bearing in mind the level of funding needed to implement the activities between now and the year 2000,

RESOLVES:

1. To approve the Plan of Action for Measles Elimination in the Americas by the year 2000 as presented in the progress report of the Director (Document CD38/15).
2. To urge all Member States to adopt the strategies outlined in the Plan of Action and allocate the resources needed for its smooth implementation.
3. To congratulate Governments for the efforts implemented thus far and the strides already made towards the elimination of measles from the Americas by the year 2000.
4. To request the Director to make every possible effort to secure the international resources needed to support the national efforts.

(Adopted at the fifth plenary session, 27 September 1995.)

December 1995
Volume XVII, Number 6

First Ladies of the Americas Reaffirm Commitment to Measles Elimination

During the "Fifth Conference of the Wives of Heads of State and of Government of the Americas", held in the city of Asuncion, Paraguay, on October 16-19, 1995, the First Ladies of the Western Hemisphere reiterated their commitment to work in favor of the health and education of women and children, under the principles of comprehensive development, equity, democratization of information and awareness, and family and social participation.

"We recognize that our countries face common challenges regarding the health and education of women and children, and that by sharing experiences and promoting regional actions through these conferences, we can foster the development and the wellbeing of our nations," the First Ladies' Declaration of Paraguay stated.

Particular attention was placed on strengthening the Region's efforts to reduce maternal and child morbidity and mortality rates. Each year nearly 500,000 children under 1 year old die in Latin America and the Caribbean, of which approximately 350,000 die from preventable causes. There are also some 17,000 maternal deaths each year. Within the framework of each country's national interest and legislation, the First Ladies encouraged and supported the implementation of the agreements and recommendations reached at the World Summit for Children, the United Nations International Conference on Population and Development. the Summit of the Americas, the United Nations World Summit on Social Development, and the United Nations Fourth World Conference on Women.

The official Declaration made specific reference to attaining the goal to eliminate measles in the Americas by the year 2000. The First Ladies pledged to "work with Ministries of Health, the Pan American Health Organization (PAHO), and other international organizations on the campaign to eliminate measles transmission from the Americas by the year 2000, and strengthen the surveillance of vaccine-preventable diseases."

Other recommendations included a call to further promote women's and girls' access to formal and non-formal education, especially in poor rural areas and marginalized urban areas, and to contribute to the prevention and elimination of all forms of violence against women and children through the provision of norms and adoption of necessary mechanisms.

The First Lady of Panama presented a Plan of Action to follow up the Region's current efforts towards the elimination of measles. During her presentation, the following messages were stressed:

The Plan of Action proposes that each First Lady implement the following steps in their own country:

Step 1: Guarantee the purchase of vaccines and the cold chain in every country.

Action to be taken:
Ensure the allocation of specific funds within the national budgets.

Step 2: Guarantee the participation of civil society.

Action to be taken:
- Establish and chair national surveillance committees for the eradication of measles which would include:
  - Government officials
  - Local authorities
  - Organized communities
  - Civic organizations
  - Churches
  - Nongovernmental organizations
  - International agencies

Step 3: Evaluate the progress of national objectives.

Action to be taken:
- Evaluate and analyze progress reports on a quarterly basis.

Step 4: Accompany the processes of regional campaigns.

Action to be taken:
- Present biannual reports to the pro-tempore Secretariat.
- Maintain the topic on the agenda until the goal is reached.

Step 5: Disseminate this commitment on a national and international level.

Action to be taken:
The Fifth Conference of Wives of Heads of State and of Government of the Americas recommends that this strategy be a national priority in the countries.

Only then, will we have the Americas Free of Measles!

The First Ladies of the Americas agreed to hold their 6th Conference in the Republic of Bolivia in 1996, and to form a new pro-tempore Secretariat composed of the offices of the First Ladies of Bolivia, Paraguay and Panama.

Measles is highly dangerous!

- It attacks 100% of all unimmunized children
- It can kill 10-20% of those who have contracted the disease
- A 30% of all cases develop complications:
  - Otitis media
  - Conjunctivitis
  - Diarrhea
  - Malnutrition
  - Encephalitis
  - Death

December 1995
Volume XVII, Number 6

Measles at an All Time Low in the Americas

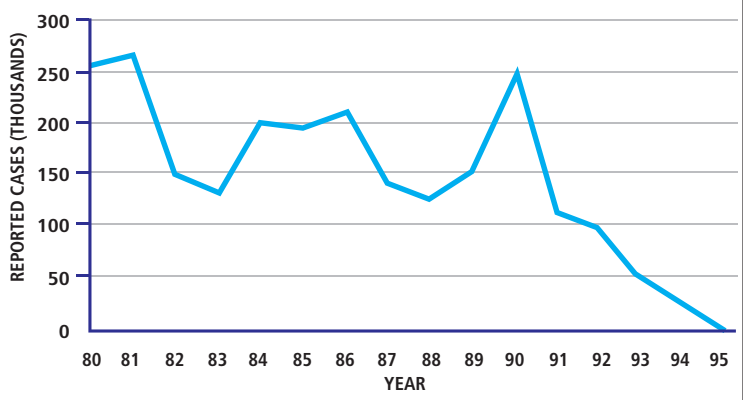
As of 25 November 1995, a total of 4,551 confirmed cases (including both clinical and laboratory diagnosed cases) were reported from the countries of the Americas, compared to 23,583 in 1994. This is the lowest number of cases reported since measles surveillance began. Record low levels of measles cases have been reported from nearly every country of the Region. The provisional annual measles incidence rate was 0.48 cases per 100,000 population; this represents a 99% reduction from the incidence rate reported in 1980. Furthermore, in over twelve months there has not been a single confirmed importation of measles from Latin America and the Caribbean into the United States, another important indicator of control of the disease in those areas. Current efforts are targeting the improvement of measles surveillance and that of laboratory diagnosis.

The majority of the total confirmed cases, 2,266 (49.7%) came from Canada. An additional 827 cases (18.6%) were reported from Ecuador. In the Region, over half of the total confirmed cases, and nearly 80% of the laboratory confirmed cases were reported from Canada. The overwhelming majority of Canada's cases were reported from the province of Ontario. Similarly, the highest national incidence rates were also found in these two countries (Canada, 8.0 cases per 100,000 population and Ecuador, 7.2 cases per 100,000 population). Other countries reporting low rates included Brazil, Mexico, and those of the Latin and English-speaking Caribbean (Figure 1).

Of the 41 countries which submit weekly measles surveillance reports to PAHO, 21 (51.2%) did not report a single confirmed case of measles during 1995. In these countries, a total of 714 persons presenting fever and rash illnesses were fully investigated and none had laboratory evidence of measles virus infection.

Furthermore, it has been over 4 years since the last laboratory confirmed case was reported from the English-speaking Caribbean and over 3 years since the last laboratory confirmed case was reported from Chile and Cuba.

FIGURE 1 Reported measles cases, Region of the Americas, 1980–1995.*



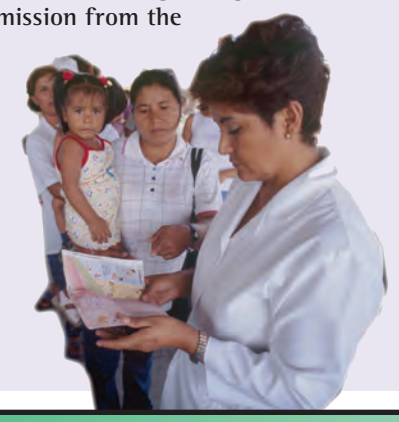
*Cases reported through 25 November, 1995.
Source: SVI/PAHO.

Editorial Note:

Data from regional measles surveillance provide strong evidence that the transmission of the measles virus has been greatly reduced, if not eliminated, in virtually all the Region. These data clearly represent the impact of the "catch-up" measles vaccination campaigns, which, by the end of 1995, will have been conducted in all countries of the Region, with the exception of the United States and Canada.

Despite vaccination coverage of nearly 100%, measles transmission has continued to occur among school-aged children in Canada. To reduce measles susceptibility in this age group, health authorities are discussing possible remedial vaccination strategies. Options include conducting a "catch-up" campaign among school-aged children, introduction of a two-dose measles vaccination schedule, or a combination of both strategies.

Although the circulation of the measles virus has been reduced to record low levels in the Western Hemisphere, it continues to circulate freely in other parts of the world. In the age of rapid intercontinental travel, the risk of measles importations will remain a constant threat. To achieve the regional goal of the elimination of measles transmission from the Americas by the year 2000, all countries must keep routine vaccination of each successive birth cohort to maintain high levels of population immunity, supplemented with periodic "follow-up" measles vaccination campaigns among preschool-aged children.



1996

February 1996
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Four Years Without Measles!

The Twelfth Meeting of the Caribbean EPI Managers, held in San Juan. Puerto Rico, from 13-16 November 1995, reviewed the successful results of the measles elimination strategies currently being implemented throughout the English-speaking Caribbean. It has been four years since the last laboratory confirmed case was reported in the area. This achievement follows the region's commitment to conduct mass Immunization campaigns which have reached over 90% of all children between 9 months and 14 years of age and the development of sensitive surveillance systems. The English-speaking countries of the Caribbean have been pioneers in defining measles surveillance systems and in ensuring the involvement of community groups.

During the meeting, special emphasis was given to measles surveillance, such as case classifications, laboratory diagnosis and outbreak prevention. As in other regions of the Americas, the major issue continues to be the build-up of susceptible persons among preschool children in the various countries. Participants discussed possible vaccination strategies aimed at preventing this accumulation. Monitoring the build-up of susceptible populations and promoting an aggressive response to eliminate the susceptibility of these groups are the key components of the Caribbean's measles surveillance strategy. Other topics included the maintenance of a polio free status in the area and the elimination of rubella.

Measles Elimination

Despite intensive measles surveillance and the investigation of 888 suspected cases, the clear message coming from the English-speaking Caribbean countries and Suriname for the period 1992-1994 is that there has been no documented indigenous measles transmission. The last laboratory confirmed case was in Barbados in 1991 (see Figure 1).

From 1992-1994, a pattern of higher rates of rash and fever observed at the beginning of the year has consistently coincided with the tourist high season. The lowest rates occur in August, a period when the health staff takes holidays. Rates have then increased in the latter part of the year, coinciding with the rainy season; during this time, the incidence of dengue fever has also increased.

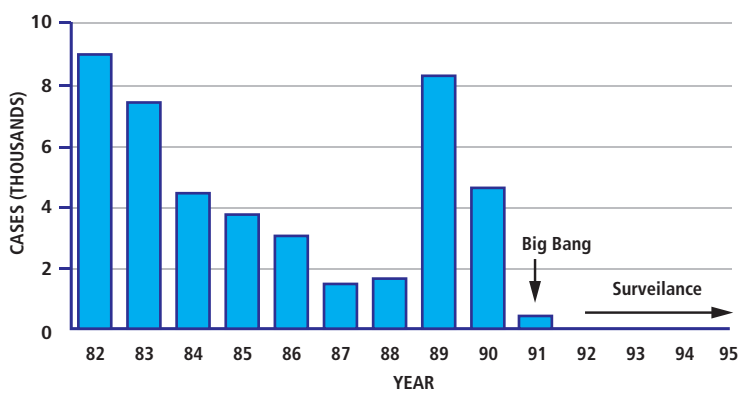
At the time of the November meeting, 300 suspected cases of measles had been reported. Of these, 274 (91%) had a first blood sample sent to the Caribbean Epidemiology Center (CAREC) and 110 had a second sample. No cases of measles were confirmed by laboratory during this period. Forty-eight (17.5%) were discarded as rubella, and nine (3.3%) were diagnosed as dengue fever.

As mentioned earlier, the accumulation of susceptible persons continues to be a source of concern. An analysis of the number of susceptible persons within the English-speaking Caribbean was updated during the meeting. According to this report, by May 1996, five years since the "catch-up" campaign, there will be approximately 107,000 children (25%) within the ages of 1-5 years susceptible to measles. These numbers exclude Jamaica and Belize, which have conducted "follow-up" campaigns. A sero-survey conducted in Jamaica in 1995, showed that sero-negative rates among vaccinated individuals averaged 15%. If these data are similar in other countries, the pool of susceptible persons may be even larger than estimated. This number of susceptible persons is more than sufficient to support a considerably large epidemic.

The current measles elimination strategy consists of four steps: national mass measles campaigns, intensification of measles surveillance, strengthening of routine vaccination activities, and the implementation of periodic "follow-up" campaigns to eliminate the build-up of susceptible persons. Virtually all countries in the Caribbean, as well as in Central and South America have already implemented the first three steps of this strategy. The fourth step, "follow-up" mass campaigns, has been conducted in Cuba, Belize, Brazil and Peru, and recently in the countries of Jamaica and Guatemala. During 1996, "follow-up" campaigns are planned by almost all countries in Central America, and in Chile.

In the countries that have fully implemented the measles elimination strategy, the detection of a suspected measles case should result in improved surveillance and case investigation, with a rapid assessment of the level of vaccine coverage and of the need to carry out mop-up activities. The implementation

FIGURE 1 Measles cases, 1982–1995, English-speaking Caribbean.



Source: Country Reports to CAREC.
Big Bang–1991 Mass Vaccination Campaign 9 mo.-14 yrs.

of special control immunization campaigns are of limited benefit once an outbreak has begun. However, once a suspected or confirmed case has been detected, all contacts 1 to 14 years of age who lack evidence of vaccination should be immunized.

The main sources for surveillance data are disease reports (from doctors, nurses, health centers and hospitals), laboratory and population data, as well as vaccination coverage. The surveillance system can also accommodate modified case definitions, therefore rubella and dengue surveillance data are also being captured. During the meeting, discussions focused on additional ways to streamline laboratory diagnosis procedures, including the shipping of specimens to the reference laboratories.

Recommendations

To enhance measles surveillance, countries should:

- Maintain heightened vigilance in the region, as well as in other parts of the world where measles is still occurring. If transmission has been eliminated, then importation is the only way that measles can reemerge and only if there are susceptible populations. Ten million tourists visit the Caribbean every year, and the Caribbean people also travel substantially. Equally important, the challenges in surveillance are now those of surveillance of a rare disease; many doctors and nurses have never seen a case.
- Upgrade the documentation when specimens are submitted to reference laboratories. It was recommended that PAHO/CAREC prepare guidelines on the subject to be disseminated among all doctors and medical schools in PAHO's Member Countries.
- Broaden the surveillance "net" to ensure that a wider number of suspected measles cases are reported. It was proposed that pediatricians and other private medical providers participate more actively in the current surveillance system, since they will most likely come in contact with imported cases. The suggested activities include:
  - meet with pediatricians, especially those who are likely to treat patients at high risk (due to migration, geographic location or tourism). Determine their familiarity with procedures for reporting suspected measles cases.
  - meet with staff at public clinics to discuss ways for involving private providers.
  - hold periodic meetings with local medical associations to explain the program and elicit support.
  - provide incentives, such as vaccine and diagnostic laboratory results for cooperation and participation in the surveillance system.

Regarding sensitivity, once a standardized case definition is used by every country, those countries with annual rates of suspected cases <10/100,000 should examine their surveillance systems to improve the detection of suspected cases.

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Update: Measles in Canada, 1995

During 1995, a provisional total of 2,301 measles cases (7.9/100,000 population) was reported in Canada. This is 4.4 times greater than the 517 cases reported for the same period in 1994, and 11 times greater than the number reported for 1993 (204). Following major increases in the number of reported cases in April and May, the incidence peaked in June with 854 cases, followed by a sharp decline in July with 260 cases (Figure 1). Data since July show a downward trend, although the reporting is less likely to be complete. Sixteen cases were reported in November, followed by an additional eight cases during the month of December.

While seven of the 12 provinces/territories reported measles activity in the past 12 months, the overwhelming majority of cases were reported from Ontario: 2,253 (98%) of the total reported cases in Canada. The provisional annual measles incidence rate in that province was 21 cases per 100,000 people. No deaths linked to measles have been reported in 1995.

Confirmation Status

Of the 2,242 case records reviewed, 1,177 (52.5%) were laboratory-confirmed: 577 of these were specified as "positive for IgM" and the remaining cases as "laboratory-confirmed." Other cases were reported as "clinically compatible;" almost half of the cases in this group were also reported as "epidemiologically linked to laboratory-confirmed cases."

Age Distribution

Cases were distributed in all age groups; the median and mean ages were 10 and 11.1 years, respectively. School-aged children (5 to 19 years) accounted for 83% of the cases.

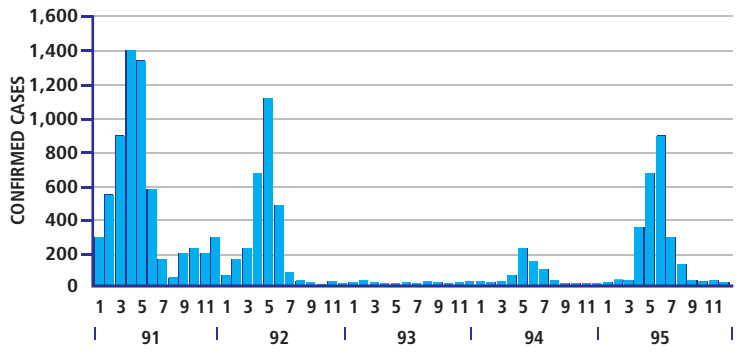
Vaccination Status and Preventability

Almost 90% of the 2,092 cases reviewed had a documented history of measles vaccination with one dose of vaccine; over 91% of these cases received vaccination between 1980 and 1994.

Based on age only, 90 cases (3.9%) were not eligible for vaccination, i.e., they were born before 1957 (19 cases) or were <12 months of age (71 cases). Immunization status was "unknown" or "unavailable" for 101 cases (4.5%).

Soure: Division of Immunization, Bureau of Infectious Diseases, Laboratory Center for Disease Control, Ottawa, Canada.

FIGURE 1 Confirmed measles cases by month of onset, Canada, 1991-1995.



Source: LCDC, Canada.

Editorial Note:

In 1995, measles cases reported from Canada accounted for 80% of the total confirmed cases (laboratory and clinically confirmed cases) and 48% of the total laboratory confirmed cases in the region of the Americas, although its population represents only 3.6% of the Region's total population. The majority of the measles cases in Canada occurred in adequately vaccinated school-aged children. Thus, measles transmission in Canada appears to be due to vaccine failure rather than the failure to vaccinate.

Measles vaccine is known to be less than 100% effective. Various epidemiologic studies have estimated its effectiveness in field conditions as being between 85 and 95%. If we assume that measles vaccine is 90% effective and that vaccine coverage in a school population is 100%, then 10% of the school population will remain susceptible to measles. Due to the high transmissibility of measles, if the measles virus is introduced into a highly vaccinated school population that has had little or no exposure to wild measles virus, there is potential for significant measles transmission. This is the likely explanation for the 1995 outbreak in Canada.

Canada's National Advisory Committee on Immunization (NACI) has reviewed the current measles situation and has made several recommendations to improve measles control in Canada. These recommendations include conducting a one-time "catch-up" measles vaccination campaign among school-aged children and the implementation of a routine two-dose schedule.

Five provinces are planning to conduct or have started "catch-up" measles vaccination campaigns among school-aged children. These provinces account for over 75% of Canada's total population and the target population for these campaigns is approximately 4.1 million children. It is likely that other provinces will conduct campaigns as well. Furthermore, a routine two-dose measles vaccination schedule has been started in four provinces and might be extended to all twelve Canadian jurisdictions within a year.

Experience from other countries of the Americas strongly suggests that, if high vaccine coverage is obtained, the "catch-up" vaccination campaign should result in the rapid interruption of measles virus circulation among school-aged children. However, in order to maintain the interruption of measles virus circulation, the major challenge for Canada in the future will be to maintain very high measles vaccine coverage in each successive cohort of newborns. If vaccination coverage can be maintained at 95% for infants by their second birthday, then the risk of sustained measles transmission in Canada will remain low.

With the implementation of these important steps, Canada now joins the other countries of the Americas in their efforts to eliminate measles from the Western Hemisphere.

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Spain Supports Measles Elimination

The Government of Spain has recently joined other members of the international community in supporting the implementation of the Plan of Action for the Elimination of Measles in the Americas by the year 2000. The Plan of Action was unanimously approved by the Ministers of Health during the XXXVIII Meeting of the Directing Council of the Pan American Health Organization held in September 1995, in Washington D.C. It will have a duration of five years (1995-2000) and will cost approximately US$ 53 million, which includes the provision of an estimated US$ 7 million from PAHO/WHO regular budgets and voluntary funds. National contributions in the order of US$ 650 million are expected.

These monies will not only support the elimination of measles, but will allow countries to sustain high levels of childhood immunization coverage and control other vaccine preventable diseases, including the maintenance of a polio free status in the Region.

The measles elimination initiative calls for the achievement and maintenance of 95% measles vaccine coverage in all municipalities or districts in every country of the Region of the Americas, with complementary periodic vaccination campaigns aimed at preventing the accumulation of susceptibles among pre-school children. To accomplish this, emphasis is placed on training personnel for effective program operations; rigorous fever and rash surveillance for the detection of suspected measles cases; and intensive social mobilization to enhance the community's role in the prevention of the disease.

Spain's grant in the amount of US$ 685,649 will be disbursed

Spain's grant will help consolidate measles surveillance in the Americas. *Source:* O. Downie, PAHO/WHO.

over a one-year period, focusing on strengthening national capabilities in the areas of measles surveillance, laboratory diagnosis, as well as training and supervision.

Due to the low number of measles cases being reported in the Region, a sensitive and aggressive epidemiological surveillance system for suspected cases of measles will be critical to the successful completion of the measles elimination strategy. This component is of utmost importance for the detection of remaining chains of transmission which could trigger an outbreak and for dealing with imported cases. With the financial support of Spain, countries plan to enhance their national surveillance systems by identifying and incorporating new reporting sources, such as non-governmental organizations, private physicians and community groups.

A key aspect of surveillance is the laboratory confirmation of suspected measles cases. A Regional Network of Reference Laboratories has been developed with PAHO's support to facilitate and promote technical cooperation among national institutions. The Network, comprised of eleven laboratories from the Americas, including Canada and the United States, has been assigned to monitor the progress made towards measles elimination (see *EPI Newsletter* of August, 1995.)

Spain's grant will be channeled to streamline the logistical aspects of national laboratories to guarantee the continued supply of standardized reagents for measles serological studies. Other activities include the production of a reference manual with laboratory definitions and procedures, and the development of a simplified kit for field diagnosis.

The grant will also complement national resources for the mobilization of health staff to conduct measles case detections and investigations, and to implement effective control measures. Another barrier that hinders the rapid deployment of health staff is the lack of funds to support per-diems and transportation. Therefore, resources will be provided, particularly in those areas considered to be at high-risk.

Priority is also being given to training at the national and local levels to regularly update health staff on recent developments in the field of measles epidemiological surveillance. Traditionally, training has served as a useful mechanism to disseminate lessons-learned from the field. For greater impact among beneficiaries, training sessions will be held primarily at the local level, and include the participation of private and public institutions. The program also seeks to enhance, through continued education and supervision, the national technical capabilities that will ensure the uniformity and quality of tests used, and the reliability of the results.

International expertise, as well as national professionals will be made available to help strengthen epidemiological surveillance. Through their collaboration, national immunization programs will be better prepared to make quick adjustments and to focus control activities on eliminating pockets of transmission.

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Decrease of Measles Cases in Mexico

Recognizing the critical nature of monitoring, detecting and resolving problems, PAHO, in collaboration with Member Countries, is carrying out "rapid surveillance evaluations" to identify obstacles which are impeding progress in the implementation of the measles elimination strategy. These evaluations seek to determine the capacity of the measles surveillance system to detect the circulation of the virus in any municipality.

An evaluation of Mexico's measles surveillance system was conducted with the participation of PAHO's Special Program for Vaccines and Immunization (SVI) to validate the decline in reported measles cases and to identify areas for improvement.

At the time of the evaluation, 1,206 suspected measles cases had been reported to the Mexican Ministry of Health in 1995. This represents a rate of 1.3 suspected cases reported per 100,000 total population, with a range per state from 0 suspected cases reported by the state of Campeche up to 3.7/100,000 suspected cases reported by the state of Chihuahua. Nine hundred and five suspected cases met the measles clinical case definition for a probable case and had a serum sample submitted to the national reference laboratory for diagnostic testing. Of these, 894 (including 13 with post-vaccination rashes) were discarded. Among the 905 sera, 488 (54%) were found to be positive for rubella IgM antibodies (see Figure 1).

In 1995, a total of 174 confirmed measles cases were reported. In comparison, over 68,000 confirmed cases were reported in 1990 (see Figure 2). Of the total confirmed cases reported in 1995, 14 (8%) were laboratory confirmed (IgM positive by Capture EIA) and 160 (92%) were confirmed only on clinical grounds (without laboratory investigation). Confirmed measles cases were reported by 21 of 32 Mexican states. Six states reported 9 clusters of 3 or more confirmed cases occurring in the same municipality, with a range of 3-20 cases. One-hundred and seven (62%) of the confirmed cases were reported from urban areas. Ninety-nine (57%) cases occurred among females. Of the 168 cases for whom age was known, 21 (13%) were under the age of one year, 26 (16%) were aged 1-4 years, and 107 (64%) were between the ages of 5-15 years. Fourteen cases (8%) occurred among persons over the age of 15 years. Of the 167 cases for whom vaccination status is known, 140 (84%) had previously been vaccinated against measles. The vaccination status of laboratory confirmed cases was similar; 12 (86%) of the 14 had previously been vaccinated against measles. The number of doses received is known for only 116 cases; 75 (65%) had received 1 dose of measles-containing vaccine, 35 (30%) had received two doses, and 6 (5%) had received three doses of the measles vaccine. Five (3%) cases required hospitalization. No measles deaths were reported.

The goals of the surveillance evaluation were to:

- describe the procedures for detection, notification, investigation and classification of suspected measles cases;
- make recommendations to improve the effectiveness of surveillance, including the development of indicators to be used for ongoing assessment of the surveillance system;
- develop a standard methodology for assessing measles surveillance in other countries.

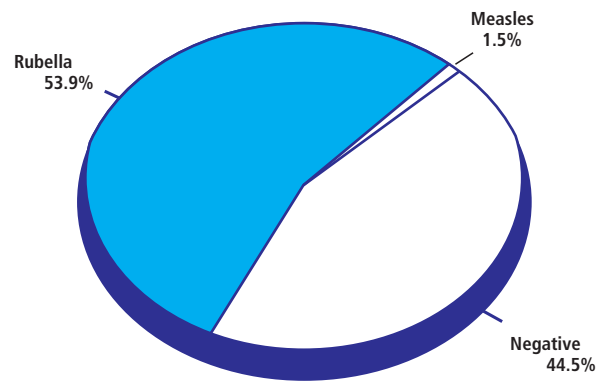
During November 27 to December 15, 1995 evaluation teams carried out site visits in 21 states, including 58 health centers or hospitals, 29 sanitary jurisdictions, and 16 state laboratories. At each site, in-depth interviews were conducted with personnel responsible for surveillance. The interviews consisted of open-ended questions about the system of case classification, reporting procedures, actions taken in response to cases detected, the process of confirming a case of measles in the laboratory, material resources, training and personnel structure of the surveillance system, and the use of indicators to determine the quality of the system. In addition to the interviews, daily patient discharge logs were reviewed to actively search for cases of fever and rash illnesses. The methodology introduced by PAHO/SVI in this evaluation is now being adapted for use in other countries of the Region.

Results

The interviews revealed that personnel had good knowledge of case definitions and procedures, and reviews of thousands of daily patient records yielded only one case compatible with the diagnosis of measles. However, the evaluation found that the process for identifying and reporting cases of suspected measles was time-consuming and complicated: different case investigation forms were needed for reporting to epidemiologists and to the laboratory and the forms were lengthy and required excessive clinical information, which was often not completed. Typically, patients needed to be seen on multiple occasions in order to determine if they satisfied the clinical case definition of a suspected measles case and to obtain a specimen for laboratory testing.

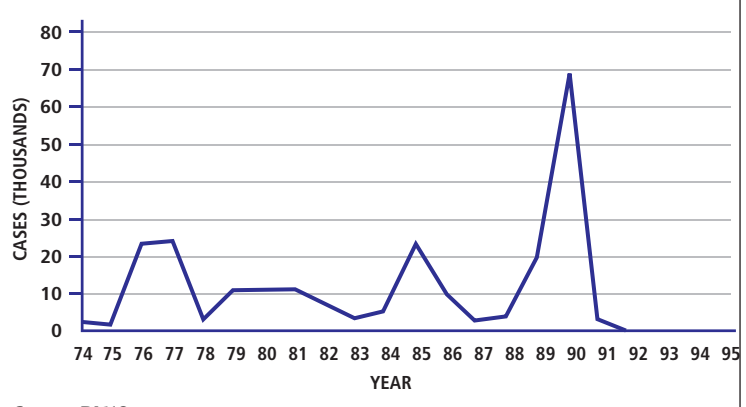
Identification of a suspected case of measles prompts an intensive surveillance effort in the community aimed at identifying contacts and susceptible persons before the case is confirmed by the laboratory. Particularly at the local level, no system for tracking suspected cases or cases that had been investigated and discarded was in use, and no standardized databases were maintained at the different levels of the system. Although the Ministry of Health's manual for measles surveillance is widely available, the need for ongoing training and feedback exists, especially at the local level. Lack of communication between the Ministry of Health's surveillance system and those of other health care providers, such as the Mexican Institute of Social Security, is also a hindrance. Finally, there is no ongoing evaluation of the surveillance system. Indicators to monitor its functioning are not being used consistently by state and local epidemiologists. These are minor problems, however, and

FIGURE 1 Results of laboratory investigation of suspected measles cases, Mexico, 1995 (n=905).



Source: Ministry of Health, Mexico.

FIGURE 2 Reported measles cases, Mexico, 1974–1995.



Source: PAHO.

only a few changes are needed to streamline the process and allow low-performing areas to be targeted for improvement.

There was a large number of suspected measles cases investigated. However, after reviewing hospital and clinic registers, the evaluation teams found only one case that fit the suspected measles case definition, which had not been reported to the surveillance system. This provides strong evidence that the Mexican surveillance system is capable of detecting measles cases and that transmission is at very low levels or may have been interrupted in the country. Despite thorough contact investigations, the inability of the surveillance system to identify chains of transmission for many of the cases raises the issue of whether these isolated cases of measles were false positives or linked to undetected importations.

Recommendations

The following specific recommendations were made to the Ministry of Health:

- simplify the definition of a suspected case to a rash of any duration, and collect a single serum sample at the first contact with the patient;
- shorten the suspected case investigation form and combine it with the form accompanying the specimen to the laboratory, in order to minimize paperwork;
- reduce the number of clinically confirmed cases;
- maintain a log of suspected cases at the jurisdictional level, in order to ensure adequate follow-up;
- develop a common database of cases to be used at the jurisdictional level and above, as well as by laboratories to improve the tracking of cases and specimens;
- strengthen training, supervision and evaluation of surveillance personnel;
- integrate other institutions into the Ministry of Health's surveillance system by standardizing surveillance training between the various institutions and by sharing a common database of cases;
- develop indicators for the quality of the surveillance system.

Adoption of these recommendations, particularly with regard to streamlining the case investigation forms and standardizing the databases will facilitate the ongoing measurements of the quality of surveillance, and further the cause of measles elimination in Mexico.

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Measles Case Classifications

The following adjustments have been incorporated into the measles case classifications (Flowchart):

I. Suspected case
All cases for which a health worker suspects measles. Patient with:

- fever and
- generalized maculopapular rash and
- cough or coryza or conjunctivitis)

II. Confirmed measles case
A suspected case which is:

1. Laboratory confirmed
   - positive for measles antibodies (by the IgM Capture test) or
   - epidemiological linkage to another laboratory confirmed case (by the IgM Capture test)
2. Clinically confirmed
   - all suspected cases without an adequate blood sample or without an epidemiological linkage to another laboratory confirmed case (by the IgM Capture test).

All *Clinically Confirmed* cases are considered failures of the epidemiological surveillance system.

An adequate sample is one taken within the initial 45 days following rash onset, and which meets requirements of proper handling, conservation and transportation.

III. Discarded case (not measles)
A suspected case in whom an adequate sample was collected, which tested negative for the presence of anti-measles IgM, through either an indirect IgM test or IgM Capture test.

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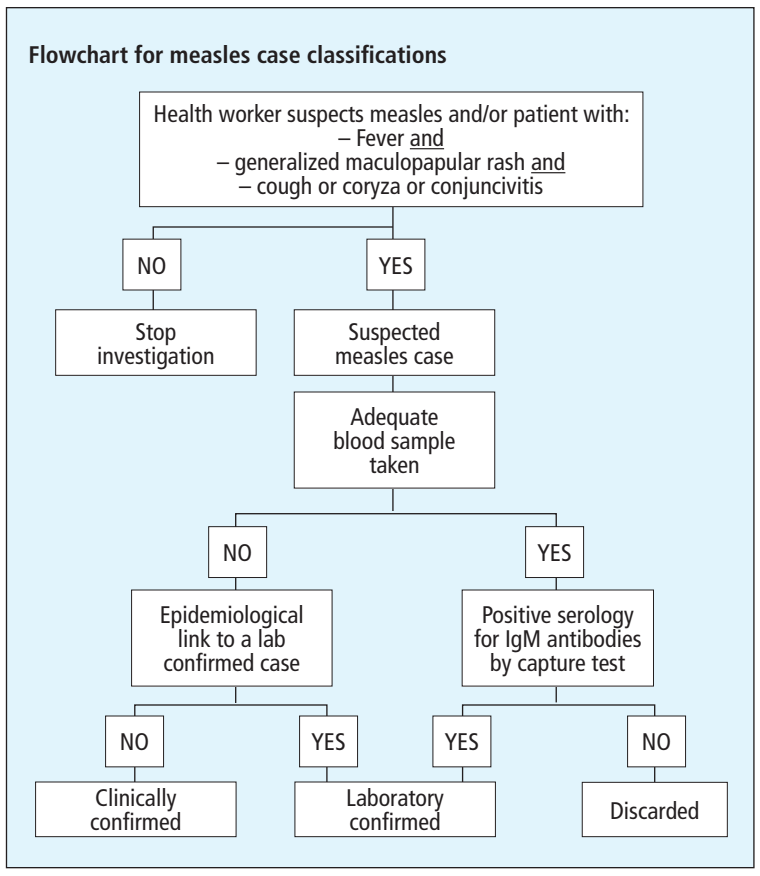
Cost-Benefits of Disease Eradication

Three million lives of children less than 5 years of age are saved annually by vaccination. Cost-benefit analyses have consistently indicated that immunization programs are the most cost-effective public health strategy for preventing infant and childhood morbidity and mortality. This assertion was most recently confirmed in the World Development Report–1993, published annually by the World Bank.

It is estimated that for every US dollar invested in vaccination, approximately US$ 7 to US$ 20 are saved as a result of the prevention of disability, death and medical costs otherwise associated with childhood diseases.



Cooperation from bilateral and multilateral agencies has stimulated the commitment of financial and human resources at the highest levels in the governments of the Region. During their 5th Meeting held in Paraguay, September 1995, the First Ladies of the Western Hemisphere endorsed the measles elimination initiative adopted by the Ministers of Health of the Americas at the September 1994, Pan American Sanitary Conference. All First Ladies pledged to work with the Ministers of Health of the Region, the Pan American Health Organization (PAHO), and other international organizations to achieve the target of measles elimination by the year 2000.

An important point to remember with polio and measles is that as long as any of these diseases is prevalent in other areas of the world, the potential for reintroduction exists, even after eradication has been successfully accomplished in one region.

Measles

According to the Journal of Infectious Diseases (JID), November 1994 issue, when measles eradication is accomplished, worldwide savings of hundreds of millions of dollars annually will be possible in both the developed and developing countries. The United States spends an average of US$ 65 per child (combining private and public sectors) to buy and administer two doses of measles, mumps, and rubella vaccine. In 1 year, measles vaccination in the United States alone costs US$ 260 million. In a decade, JID reports that conservatively assuming that prices did not rise with inflation and that unit costs fell as volumes rose, cumulative costs would reach US$ 2.6 billion.

The July 1985 issue of the American Journal of Public Health cited that the United States would save US$ 669,311,673 million in disease burden by immunizing against measles, with an estimated program cost of US$ 55,989,233 million (a cost-benefit ratio of 11.9/1).

The successful polio eradication initiative has led the countries of the Americas to strengthen their activities aimed at the control of measles. As a result of these initiatives and given the dramatic impact of PAHO's measles strategies on the incidence of the disease, the countries of the Americas have called for the elimination of measles by the year 2000.

Experience gained thus far indicates that the PAHO measles elimination strategy is proving to be effective in combating the disease. Throughout 1995, approximately 5,623 confirmed cases were reported from the countries of the Americas, compared to 23,583 in 1994. This represents a considerable reduction in the number of cases since measles surveillance began. The provisional annual measles incidence rate was 0.48 cases per 100,000 population; this represents a 99% reduction from the incidence rate reported in 1980.

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USA Supports Measles Elimination

The United States of America, through its Agency for International Development (USAID), has approved a US$ 8 million grant in support of the Pan American Health Organization's (PAHO) goal to eliminate measles in the Americas by the year 2000. Over a period of five years (1996-2001), the USAID grant will complement Regional efforts toward achieving measles elimination. The USA support was first pledged by the First Lady, Mrs. Hillary Rodham Clinton, during her visit to PAHO on the occasion of World Health Day 1995.

USAID played a key role in the successful completion of the poliomyelitis eradication initiative in 1994, contributing approximately 60% of the external costs associated with the hemispheric campaign against polio. With the announcement of this new grant agreement, the United States is reaffirming its commitment to immunization, which is recognized as an effective public health strategy to safeguard the well-being of children in the Americas.

"Follow-up" Measles Campaigns

In 1995 record low levels of measles cases were reported from nearly every country of the Region. However, as long as the measles virus circulates in the rest of the world, the risk of importation remains.

A major obstacle to measles elimination is the accumulation of susceptible preschool-aged children. As the proportion of susceptibles expands, the risk of a measles outbreak increases,

TABLE 1. Measles vaccination coverage achieved through catch-up and follow-up campaigns in the Americas, 1987–1996.

Country	Catch-up campaigns			Follow-up campaigns				
	Year	Target group age	Coverage	Year	Target age group	Children vaccinated	Target population	Coverage
Cuba	1987	1–14 years	98%	1993	2–6 years	888,000	898,000	99%
Belize	1991	1–14 years	82%	1995	1–4 years	25,000	34,000	74%
Jamaica	1991	1–14 years	71%	1995	1–10 years	423,223	499,723	85%
Brazil	1992	1–14 years	96%	1995	1–3 years	6,461,899	8,357,172	77%
Chile	1992	1–14 years	99%	1996	1–14 years	4,060,759	4,022,026	100%
Peru	1992	1–14 years	75%	1995	1–4 years	2,386,027	2,465,277	97%
Colombia	1993	1–14 years	96%	1995	1–3 years	2,046,619	2,286,218	90%
El Salvador	1993	1–14 years	96%	1996	1–4 years	437,500	535,000	82%
Guatemala	1993	1–14 years	85%	1996	1–4 years	899,110	1,500,000	60%
Honduras	1993	1–14 years	96%	1996	1–4 years	585,585	691,506	85%
Nicaragua	1993	1–14 years	94%	1996	1–4 years	513,385	529,306	97%
Panama	1993	1–14 years	88%	1996	1–4 years	229,641	243,877	94%

Source: PAHO/WHO and country reports.

should measles virus be re-introduced. To prevent this, periodic "follow-up" measles campaigns are being conducted throughout the Region, focusing on all children aged 1 through 4, regardless of previous vaccination or disease history.

PAHO recommends "follow-ups" whenever the number of susceptible preschool children has approached the size of an average birth cohort. The interval between these campaigns and the specific age group targeted will depend on the vaccination coverage obtained through routine services since the last campaign.

Cuba conducted its "follow-up" campaign in 1993; Belize, Brazil, Colombia and Jamaica in 1995; and Chile and the countries of Central America conducted campaigns during April 1996 (Table 1). To date, these campaigns have reached approximately 19 million children. "Follow- up" campaigns are planned for the remaining countries of the English-speaking Caribbean later in 1996.

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Measles in the United States, 1995

As of March 20, 1996, local and state health departments had reported a provisional total of 301 confirmed measles cases to the Centers for Disease Control and Prevention (CDC) for 1995. This represents the lowest number of cases ever reported in 1 year since measles first became notifiable in 1912 and a 69% decrease from the 963 cases reported for 1994. This report summarizes the epidemiologic characteristics of measles cases reported in the United States in 1995, and documents important epidemiologic trends, including a shift in age distribution and the continued occurrence of international importations.

Age

Of the 285 measles patients for whom age was known, 109 (38%) were aged <5 years, including 39 (36%) aged <12 months and 34 (31 %) aged 12-15 months. A total of 64 (22%) measles patients were aged 5-19 years, and 112 (39%) were aged ≥20 years. Of the 33 measles patients with internationally imported cases, eight (24%) were aged <5 years, 14 (42%) aged 5-19 years, and 11 (33%) aged ≥20 years.

Vaccination Status

Vaccination status was reported for 219 (73%) measles patients. Among the 96 (44%) who were not vaccinated, 56 (58%) were eligible to be vaccinated (i.e., aged >12 months and born after 1956). Vaccination status varied by age group: 29 (55%) patients aged 1-4 years were unvaccinated, compared with 12 (26%) aged 5-19 years and 28 (32%) aged ≥20 years. Of 62 measles patients for whom data were available about dates of vaccination, 55 (89%) had received at least one dose of measles-containing vaccine (MCV) on or after their first birthday and ≥14 days before onset of symptoms; seven (11%) were considered to be unvaccinated or inadequately vaccinated; three (5%) received their first dose of MCV <14 days before onset of symptoms; and four (6%) had received one dose of MCV before their first birthday. Five (8%) cases were reported among persons who had received two doses of MCV after their first birthday.

Case Classification

Among the 301 reported cases, 268 (89%) were indigenous to the United States, including 259 cases (86%) acquired in the state reporting the case and nine (3%) resulting from the spread from another state. International importations accounted for 33 cases (11%), and an additional 11 cases were epidemiologically linked to imported cases of measles. Importations originated from or occurred among persons who had travelled in Germany (10), Canada (three), Italy (three), Pakistan (three), China (two), France (two), Malaysia (two), Austria (one), Belgium (one), Costa Rica (one), Egypt (one), Japan (one) and the Philippines (one). For two of the imported cases, the exact source was unknown because the patient had travelled in more than one country outside the United States during the exposure period.

Outbreaks

Nineteen outbreaks (i.e., clusters of three or more epidemiologically linked cases) were reported by 12 states in 1995 and accounted for 74% of all reported cases. Five of these outbreaks began in late 1994. The number of cases involved in outbreaks ranged from three to 73 (median: seven cases). The largest outbreak (73 cases) occurred in a community in Ventura County, California, and primarily involved adults. Two outbreaks (25 cases in New Mexico and 17 cases in Louisiana) occurred primarily among unvaccinated children in day-care settings, and a fourth outbreak (13 cases) occurred among students in a college in Washington. The outbreak that occurred latest in the year primarily involved adult members (nine cases in 1995, 18 in 1996) of a group in Minnesota that declines vaccination because of religious reasons.

CDC performed genomic sequencing of measles viruses isolated from five different outbreaks in 1995. None of the sequences was related to genotypes of viruses circulating during the measles resurgence in the United States during 1989-1991. The isolates from 1995 are genotypically similar to viruses recently isolated in Europe and Japan.

Reported by: State and local health departments. Measles Virus Section, Respiratory and Enteric Viruses Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases; National Immunization Program, CDC.

Source: MMWR, Vo1.45, No.15; April 19, 1996.

Editorial Note:

Similar to the rest of the Western Hemisphere, in 1995 the United States has provisionally reported a record low number of measles cases since surveillance was instituted in 1912. The 301 confirmed cases represent a 98.9% reduction compared to those reported in 1990.

An increased percentage of measles cases was reported among persons ≥20 years of age. This change in the epidemiology of measles is due to major advances achieved recently in the United States in raising and maintaining high levels of measles immunity among preschool and school-aged children.

Nearly 15% of these cases were reported to have acquired measles infection in another country or were cases linked to an international importation. Of the 33 international importations, only 4 (12%) were reported to have acquired measles from another country within the Americas. In comparison, during 1990 over 200 measles cases were imported to the United States from Latin America. Most had originated in Mexico, and these represented over 80% of the total imported measles cases to the United States. Since then, the number and proportion of importations from Latin America and the Caribbean has decreased markedly.

Of the four documented international importations from the Americas during 1995, three were from Canada and one was from Costa Rica. Canada experienced a large measles outbreak during 1995, and given the high level of communication between the two countries, it is not surprising that some "spillover" occurred. The case reported as imported from Costa Rica, however, deserves further discussion. This case occurred in a 54 year-old American citizen who developed a febrile rash illness four days after returning to the United States following a three-week stay in Costa Rica. The patient was examined by a physician and met the clinical case definition. Blood samples drawn on the day of rash onset and three weeks later were positive for measles IgM antibodies by indirect EIA in two different laboratories. No confirmation by the "gold standard" IgM Capture test was performed.

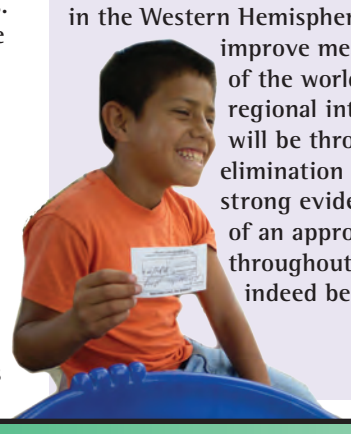
The Pan American Health Organization questions the classification of this case as confirmed for the following reasons: first, the laboratory results were not validated by the IgM Capture test; indirect IgM tests may produce false positive results, especially in settings where measles incidence is low. For this reason, PAHO requires an IgM Capture assay for a case to be classified "laboratory confirmed." Second, despite adequate surveillance, there was no documentation of measles virus circulation in Costa Rica during 1995. An active search following the notification of this case failed to detect any measles transmission in the country. Finally, the patient's age makes the measles diagnosis less likely. The overwhelming majority of persons born before 1957 in the United States are immune to measles.

The criteria used by countries to classify measles cases as being indigenous or imported need to be well-defined and standardized. Some currently used criteria were developed at a time when measles virus was circulating freely in most countries in the Western Hemisphere. If a person were to develop measles after travelling to virtually any country in the world, it could be safely assumed that he or she had acquired the infection in that country.

However, the epidemiologic situation is quite different in 1996. Measles is now a rare infection in Latin America and the Caribbean. Surveillance evaluations conducted recently in Mexico and in El Salvador did not detect any evidence of sustained measles transmission. Many countries in the Americas have experienced two or more measles-free years. Furthermore, those countries that are reporting confirmed measles cases have only reported sporadic cases which are isolated in terms of time and place. These cases have been labeled "spontaneous" since virtually all lack both a source of infection and documented transmission. A possible explanation for these confirmed cases is that they may be false positive laboratory results.

Measles virus circulation has been greatly reduced, if not eliminated, in most areas of the United States. The challenge now for the United States and other countries of the Region is to maintain the interruption of measles transmission, given the ease with which importations can occur.

In addition to maintaining high levels of population immunity in the Western Hemisphere, increased efforts are needed to improve measles control in other regions of the world. The only way to ensure long-term regional interruption of measles transmission will be through global eradication. The measles elimination experience in the Americas provides strong evidence that given the implementation of an appropriate vaccination strategy throughout the world, measles eradication can indeed be achieved.



June 1996
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Measles Surveillance: El Salvador

At the request of the Ministry of Health, an evaluation was conducted in February, 1996, in El Salvador to determine the capacity of the national epidemiological system to promptly detect the circulation of the measles virus in all municipalities of the country. The evaluation sought to:

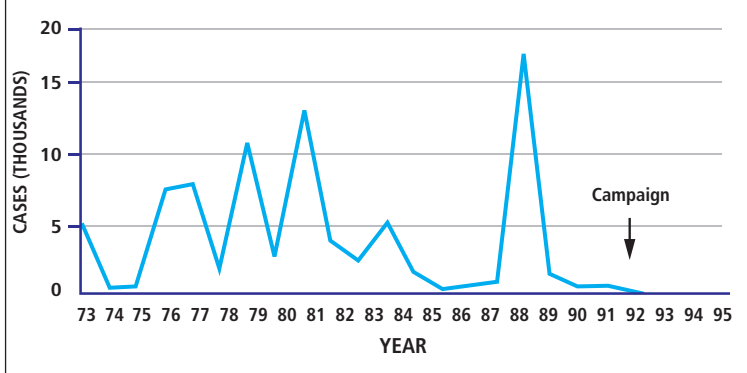
- assess the procedures for detection, reporting, investigation and classification, and the performance of laboratories in the surveillance of suspected measles cases at the different levels of the health system;
- identify problems and make concrete recommendations to enhance surveillance at the various levels.

Structured interviews were conducted with health workers at 12 departmental offices, 6 hospitals, 5 health centers, 25 health units, the National Office for Epidemiology, the Maternal and Child Health Office of the Social Security Department, the Central Virology Laboratory and the EPI national coordinating center. Furthermore, approximately 12,000 registers of patients' visits to doctors and emergency services at hospitals were reviewed, as well as the national measles surveillance database. Emphasis was placed on visiting high-risk areas.

Results

The evaluation determined that 90 to 95% of the health units were reporting regularly on a weekly basis. During 1995, a total of 278 suspected measles cases were reported

FIGURE 1 Reported measles cases, El Salvador, 1973–1995.



Source: MOH, El Salvador.

to the Ministry of Health. Seventy percent of cases were investigated within the first 48 hours following notification. Ninety-four percent of the suspected cases had an adequate serum sample collected, and 63% had a second sample collected. Of all the blood samples tested, nine were positive for measles by the commercially available indirect IgM test; each of these positive specimens was re-tested in Panama using the highly specific IgM Capture test, and all tested negative. The initial laboratory results are thus considered to be "false-positives." False positive test results are expected in a percentage of suspected measles cases, due to the relatively low specificity of the commercially available IgM tests and the absence of measles transmission in many parts of the Americas. Six cases were "clinically confirmed;" that is to say that measles virus infection was suspected by a health care worker, yet an appropriate laboratory investigation was not conducted.

Health personnel are aware that any case of measles should be notified immediately. At the operational level, however, the implementation of the measles case classifications needs to be strengthened. At this point, only cases with samples are incorporated into the surveillance system. Weekly negative reporting from the department level is not consistently reaching the central level. The existing network of health promoters has facilitated case reporting within their respective communities. Surveys of patients attending health centers, which were carried out at some health units, also represent an example of community surveillance. However, alternative notification sources need to be further identified and incorporated into the national surveillance system.

Approximately 80% of reported cases examined by the evaluation team were well investigated. The current system seeks samples from all suspected cases. El Salvador's central laboratory has the technical competence to process samples and the coordination between the laboratory and the epidemiology center is adequate at the central level. Case investigation forms, however, require too much information and are difficult for health care workers to complete. There are some delays with the processing of samples, reporting of results to the local levels and shipping of positive samples to the reference laboratory. The availability of a central distribution entity for biologics is considered to be an essential step to ensure the proper functioning of laboratories. Equally essential will be the steady flow of communication between the central laboratory and the Regional Reference Laboratory in Panama.

A formal organizational structure is in place at the department level, which facilitates collaboration with the local systems. There is an Inter-Agency Coordinating Committee (ICC) at the national and departmental levels and in some municipalities. Nevertheless, departments find themselves at various levels of managerial development. The availability of health staff trained in epidemiology needs to be addressed. Also, some departments lack designated staff to follow-up on the measles elimination effort.

El Salvador has a computerized database at the national level which allows for periodic analysis of measles surveillance indicators. Monitoring and evaluation of vaccination coverage is performed at all levels. Through this system, the country has identified areas at high-risk for measles. There is a greater need to expand the reach of information related to measles among departments and among the various organizations involved in the measles elimination efforts. The program could also benefit from formal, ongoing feedback mechanisms for measles surveillance data.

The evaluation team concluded that there is no evidence of measles circulation in the country at the present time. Although there are some areas that require improvement, the surveillance system appears capable of promptly detecting the presence of measles virus circulation in most municipalities. The marked decrease in the number of measles cases is an indicator of the impact of the mass immunization efforts and the maintenance of high vaccination coverage levels.

Recommendations

- PAHO's recommended operational case classifications for suspected measles cases should be used to avoid confusion. All suspected cases of measles, including those that lack serum samples, should be included in the surveillance system.
- Efforts should be made for greater integration of other health sector institutions, at all levels, into the national surveillance system. Local epidemiological surveillance should continue to be expanded through health promoters and further use of surveys of persons using health facilities.
- El Salvador's central laboratory should participate in the final classification of cases, and efforts should be made to improve communication between the national Central Virology Laboratory and the Regional Reference Laboratory in Panama. Samples should be processed at least twice a week in the national laboratory. All positive sera and a 10% random sample of negative sera should be sent on a monthly basis to the Regional Reference Laboratory in Panama for quality control purposes. The laboratory should be authorized to ship the results directly to the reporting unit in a timely manner. Supervision needs to be strengthened at the Reference Laboratory. Also, a computer system should be installed at the central laboratory to facilitate data management and analysis.
- The ongoing exchange of information among departments and with different institutions needs to be promoted. An epidemiological bulletin should be re-instated and the quarterly program evaluation needs to be distributed to all health departments.
- The managerial capacity of epidemiological surveillance at the departmental level needs to be strengthened, targeting those departments that are less developed. More staff should be trained in epidemiology at the departmental level, and in overall management of the national program. Also, efforts are needed to ensure the proper functioning of all epidemiological surveillance committees in the country, and to enhance the inter-institutional coordination with NGOs and private physicians through ICC meetings. Staff should be designated at the national and departmental levels to follow-up and promote the national measles elimination activities.
- Supervision of and training in surveillance methodologies in use need to be strengthened at the departmental level and at hospitals. Due to the rapid turnover of personnel, all staff should receive training in epidemiological surveillance before entering service. At the local level, training in measles surveillance should take place by more frequent supervisory visits. The joint participation of private and public institutions at these training sessions should be encouraged.

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Canada "Catches-up" with Measles

British Columbia

In British Columbia, on January 25, 1996, the Health Minister officially announced the introduction of a routine two-dose measles and one-time "catch-up" vaccination program to begin in April 1996. Both programs started concurrently. The "catch-up" vaccination campaign was administered by public health nurses and took place in schools and other public locations. The campaign targeted all children between 18 months and those completing secondary school. Measles-rubella (MR) vaccine was used for the "catch-up" campaign.

Prince Edward Island

On February 7, 1996, the Prince Edward Island Ministry of Health announced the introduction of a two-dose measles schedule, starting in March, 1996, with the second measles-mumps-rubella (MMR) [dose] to be given at school entry for those 4-6 years of age. A second dose of monovalent measles vaccine will be offered to all students in grades 1 to 12 in 1996 as part of the "catch-up" program. This "catch-up" program started in March and will be completed this fall.

Ontario

In Ontario, a routine two-dose measles schedule with the second dose of MMR given at school entry and a "catch-up" campaign using monovalent measles vaccine for all school-aged children have been introduced. Although the "catch-up" campaigns were expected to start officially on February 1, 1996, some health units began immunizing a week earlier. As of February 20, over 400,000 children had been immunized. The program ran smoothly, and, as expected, no serious adverse events were documented. The acceptance rate was >95%.

The Yukon

In the first week of January, 1996, the Yukon Territory began implementing a routine two-dose measles schedule, with the second MMR to be given at 18 months. A "catch-up" campaign using monovalent measles vaccine and targeting school-aged children started in March.

Quebec

In some regions in Quebec, the "catch-up" program with monovalent measles vaccine targeted at school-aged children began on February 13, 1996. Province-wide implementation was expected by mid-March. The routine second dose of MMR at 18 months has already been incorporated in the regular immunization schedule. The "catch-up" program for pre-schoolers (those ≥18 months) will start at a later date, and will be done only on a progressive basis for completion by December 1996.

The current "catch-up" programs and the anticipated campaign will immediately protect approximately 75% of Canadian school-aged children.

Source: Measles Update, Vol. 4, #1, February/March 1996.

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Volume XVIII, Number 4

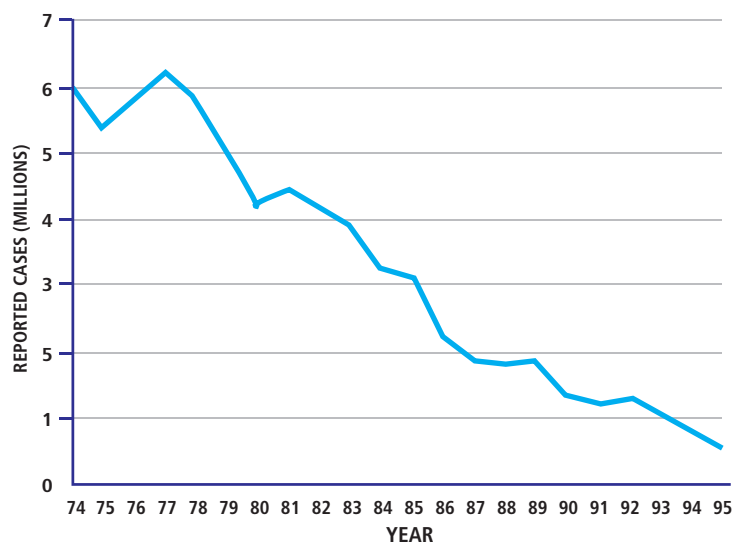
Global Measles Eradication: Target 2010?

During a two-day consultative meeting co-sponsored by the Pan American Health Organization, the Centers for Disease Control and Prevention, and the World Health Organization held on July 9-10 in Atlanta, Georgia, public health officials from around the world reviewed the record of current measles control strategies and debated the feasibility of expanding the target of measles elimination in the Americas to global measles eradication.

The Facts

According to WHO's 1996 World Health Report, before a vaccine became available in the 1960s, each year measles killed between seven and eight million children and caused an estimated 135 million cases worldwide. Today, approximately one million

FIGURE 1 Global annual reported measles cases, 1974–1995.



Source: WHO/EPI.

children still die annually from measles and countless others have permanent sequelae of their infection, the great majority of whom live in developing countries. Measles continues to be the leading killer among childhood vaccine-preventable diseases, affecting mainly malnourished children and those who live in crowded urban conditions.

The World's Record

Remarkable progress has been made in measles control elimination during the past 3-5 years (see Figure 1). In this regard, the Region of the Americas has clearly shown the possibility of effective measles eradication. Measles transmission has been interrupted in major portions of the Americas, leading PAHO and all the countries of the Region to set the goal of measles elimination by the year 2000. Progress towards measles elimination in the United Kingdom and the Scandinavian countries has also been dramatic. The mass immunization strategies being carried out in the Americas and some nations in Europe and the Eastern Mediterranean regions are being considered by several countries in Africa and Asia, where measles continues to be a considerable burden.

Global Roundtable

Global measles eradication: a feasible goal. Global measles eradication is technically feasible. Participants representing several developed and developing countries agreed that national, sub-regional, and regional elimination of measles can and should be accomplished. Eradication was defined at the Atlanta Meeting as the global interruption of measles transmission. Vaccination would not need to be continued following eradication. Elimination refers to the interruption of transmission in a sizable geographic area, such as a country or a region. However, because of the continued threat of re-introduction of the virus, vaccination would need to be continued. Global eradication will basically represent the sum of successful elimination efforts in all regions. Elimination has been achieved already in some areas for limited periods of time.

Favoring an initiative to eradicate measles worldwide within the next 10-15 years are: the expected success of polio eradication by the year 2000; the success to date of measles elimination in the Americas and United Kingdom; the urgency of measles eradication because of expected epidemiologic changes resulting from routine measles vaccination (i.e., the accumulation of a growing population of susceptible adults); the high benefit:cost ratio to developed countries; and the recognition of measles as a major public health problem in many developing countries, which should help engender the necessary political and financial support.

Participants concluded that a goal of global measles eradication should be established, with a target date within the next 10-15 years (e.g., between 2005 and 2010). Measles eradication is a logical addition and follow-up to the current global polio eradication initiative, but needs to build on the success of polio eradication. Therefore, it should await maturation of the polio eradication program and be implemented as countries and regions become polio free. Given the rapid accumulation of susceptibles to measles, the implementation phase of an eradication effort should be compressed into as brief a time as possible.

Targeting immunization strategies. Great success has been attained in many countries, particularly those in the Americas, using a three-step strategy beginning with "catch-up" mass campaigns to vaccinate all persons 1-14 years old regardless of prior vaccination status, followed by high coverage through routine vaccination of children 9-15 months of age ("keep-up"), supplemented by periodic "follow-up" mass campaigns aimed at all children 1-4 years old, since susceptible children will accumulate among one-dose vaccine failures and unvaccinated children. Measles eradication will require more than a routine one-dose vaccination strategy. However, participants stated that no single two-dose approach is optimal for all countries. It is essential to reach all children with at least one dose of measles vaccine. The second dose provides an additional opportunity to reach those children who either did not acquire immunity following vaccination, or who missed the first dose. Also, evidence indicates that a second dose of measles vaccine gives very high rates of seroconversion (>90%) in those who did not respond to a first dose.

In countries with highly developed immunization programs capable of reaching extremely high coverage on a routine basis, it appears that an ongoing two-dose schedule can successfully achieve national elimination of measles. Countries switching from a one-dose strategy to an elimination strategy will need to implement some form of "catch-up" campaign, rather than just gradually adding a second dose to the immunization schedule. Regardless of the strategy selected, attention should be paid to preventing the accumulation of susceptible children.

In countries currently using rubella vaccine or considering initiating a rubella control program, using a combined measles-rubella or measles-mumps-rubella vaccine is recommended, in order to take full advantage of the "catch-up" campaigns.

Current measles vaccines are sufficient. Existing vaccines and strategies are sufficient to eradicate measles. Nonetheless, alternative methods of delivery, particularly jet injectors, and alternative preparations of the vaccine should continue to be explored. The most pressing research need is for a rapid field diagnostic test. Other topics of research interest discussed by participants included continued studies to better understand measles virus and the mechanisms of action of measles vaccines.

Measles surveillance is critical. Measles case surveillance is a critical component of an elimination/eradication strategy and needs to be implemented at an early stage of the program. The most important functions of surveillance are to assess the adequacy, implementation and effectiveness of elimination strategies, and to detect the circulation of measles virus in a population, rather than finding every case of measles infection, except at the end stages of elimination.

Surveillance indicators are a useful means for monitoring surveillance systems but must be limited in number to be optimally effective. No external standard for determining the completeness of measles surveillance exists which is comparable to the reporting rate of acute flaccid paralysis (AFP) cases for polio. Experience in using indicators is limited, and the indicators proposed may need to be modified based on accumulating experience.

Among appropriately trained health care providers, a passive system of surveillance for measles is adequate. There may be settings, however, where active surveillance assumes a more important role, for example, in some urban settings where there are dense populations of unvaccinated children, in areas that have a low rate of notification or where a confirmed case has been identified, or in areas where clusters of suspected cases have occurred.

There was a consensus among participants to base case notification on a clinician's suspicion rather than attempting to implement rigid case definitions for notification purposes. Such case definitions are important, however, in investigating suspected cases and in classifying them following investigation.

Laboratories as key partners. Laboratory confirmation of measles infection will play a significant role as measles incidence declines. Also, the establishment of a functioning global network of laboratories will be a critical element in achieving global eradication.

Laboratories will also play a vital role in characterizing measles virus isolates, to determine whether cases are due to indigenous transmission or importations. This information will be important as countries interrupt the transmission of indigenous strains. For example, it appears that all measles viruses isolated in the United States in the past two years share characteristics with virus strains from other countries, not with the strains that had been circulating in the United States in 1989-1992. Although seven different groups of virus strains have been identified, evidence indicates that current vaccines are effective against all of them.

The surveillance of measles immunity is another significant function of laboratories. Although monitoring immunization coverage is important in indicating the likely levels of immunity within a community (and coverage should be monitored at the district level), the occurrence of vaccine failures means that serological measures may be useful in confirming the level of protection in an area.

Efforts should be made to confirm all sporadic cases and at least one case from each chain of transmission. The availability of a rapid field diagnostic test will be of great help. In addition to serum or saliva specimens for laboratory confirmation, specimen collection for virus isolation should be done in conjunction with case investigation, as the greatest yield occurs when specimens are obtained within seven days of rash onset. Specimens can include urine, as well as nasopharyngeal swabs or blood.

Re-defining importations

As more countries achieve interruption of measles virus transmission, importations will become more prominent. Many persons who develop measles may have travelled outside their home country during some part of their presumed exposure period or may have travelled to countries where measles virus is not thought to be circulating. Ascribing the source of imported cases may be difficult, and it may be useful to consider the following classification scheme for confirmed measles cases: indigenous; source unknown; imported (source known); and imported (source unknown). Collaboration between countries in attempting to establish the source of cases can be facilitated by PAHO/WHO offices. In general, importations into the United States have not resulted in the re-establishment of transmission, but have died out within a few generations of cases.

Learning from outbreaks. Prevention of outbreaks is much more effective than trying to contain them. Attempting to

terminate measles transmission in response to outbreaks has a very limited role in measles eradication in most countries, because such efforts are costly, disruptive, and, by the time such measures are instituted, they may be ineffective. However, outbreaks may be used as opportunities to reinforce surveillance, assess the health burden of continuing measles transmission, and determine the cause of the outbreak so that appropriate preventive measures can be taken. Careful investigation of outbreaks can generate the data needed to obtain the political will for eradication.

Obstacles to measles eradication. Major obstacles to measles eradication are perceptual, political, and financial. In many countries, the true nature of measles is not understood and it is perceived as a minor illness. This is particularly true in developed countries. This perception may make it difficult to develop the political will necessary to carry out a successful global eradication effort. There is a need to educate parents, medical practitioners, and public health professionals in such countries. On the other hand and as mentioned earlier, measles is widely recognized as a major killer in many developing countries, where support for its eradication is expected to be very strong. Although it may seem costly in the short-run, measles eradication will quickly pay for itself in vaccinations and hospitalizations forgone and deaths prevented. Documenting the health burden of measles in more countries, especially in the developed world, will be important in gaining support for global eradication.

Source: PAHO/CDC/WHO Meeting on Advances in Measles Elimination. Atlanta, Georgia, USA.

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Cost-Effectiveness of Measles Immunization in Urban Areas

Even though globally 78% of children are immunized against measles, vaccination coverage is variable. Measles cases do not occur at random throughout the population but cluster in certain geographical areas and in certain groups of people. The city environment combines a high-risk area with a high-risk population. In fact, the majority of measles deaths happen in cities. Special efforts, such as supplemental mass campaigns, are needed to reach the urban poor who are often under-utilizers of routine immunization services.

Measles immunization has been called the most cost effective public health tool invented. There is no better return for investment than using the measles vaccines wisely. The additional resources required to control measles in cities are justifiable in both economic and humanitarian terms. When a coalition is formed that includes city authorities, community groups and the private sector, a city measles campaign becomes an efficient way of protecting children from measles.

With funding assistance from partners in immunization, the cost of an urban campaign need not be great. Experience from countries in the Americas suggests that the full cost of a measles mass campaign ranges from US$ 0.50-0.75 per child. Funds will be needed to purchase vaccine, syringes and needles. PAHO/WHO and UNICEF recommend the autodestruct syringe for campaigns such as this. While staff time may be considered a cost, existing staff can be mobilized for a day or two from the Ministry of Health or from NGOs with little extra real expenditure.

Source: Global Programme for Vaccines and Immunization, WHO, *Update*, April, 1996.

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Andean Region: Measles on the Way Out!

The VII Andean EPI Manager Meeting held in Quito, Ecuador. 27-28 August, brought together health officials, EPI managers, epidemiologists, laboratory representatives, UNICEF, Rotary International and SVI/PAHO staff to review the program's progress, especially with regard to measles elimination.

Measles Surveillance

Following SVI/PAHO's strategy for eliminating measles, all countries in the Andean Region have already conducted "catch-up" vaccination campaigns targeting all children between the ages of 9 months and 15 years, achieving coverage above 90%. The impact of these campaigns is evident in the marked reduction of measles incidence with only 7 laboratory confirmed cases during the first half of 1996 (Table 1). Nonetheless, many municipalities still reported routine coverage rates below 90% in 1995, and 95% (target set in 1995 for measles coverage) in 1996.

Another critical component of the measles elimination strategy to prevent the accumulation of susceptibles is periodic "follow-up" campaigns. These

were carried out in 1995 in Colombia, reaching children 1 to 3 years of age, and in Peru, aimed at all children under 5 years of age. During 1996, Chile completed its "follow-up" campaign, reaching children between the ages of 1 and 14 years of age. The coverage rates of these campaigns were 90% or higher (Chile, 100%; Colombia, 90%; and Peru, 97%). The critical number of susceptible children to measles infection has been estimated as equal to one year's birth cohort for each country. Considering this trend, Ecuador should carry out a "follow-up" campaign in 1997, Bolivia and Peru in 1998, and Venezuela in 1999.

Countries in the Andean Region began to systematically implement a national surveillance system for measles in 1995. Efforts are needed to continue strengthening these systems to reduce the number of clinically confirmed measles cases reported.

Recommendations

- Implement the new definition of a suspected measles case.
- Reach and maintain routine vaccination coverage greater than 95% for children 12 to 23 months in each municipality.
- Continue ongoing monitoring of the build-up of susceptibles and carry out "follow-up" campaigns to prevent outbreaks when this number equals one year's birth cohort.
- Change the age for administering measles vaccine from 9 months to 12 months (for countries that have yet to implement this recommendation).
- Continue making efforts to expand the network of health units reporting measles cases.
- Make greater use of the resources offered by the Measles Elimination Surveillance System for monitoring the program in the countries.
- Assure the utilization of the key indicators for measles surveillance.
- Maintain a weekly publication of measles cases and areas with outbreaks.

Measles Diagnosis

Representatives of laboratories in Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela met to exchange experiences and discuss the implementation of uniform criteria for measles diagnosis.

Recommendations

- Only samples from cases that fit the definition of a suspected measles case will be processed.
- Only one sample will be taken from each suspected case. To be considered adequate, a sample must be taken within 30 days of rash onset.
- Upon arrival at the laboratory, all samples must include the following information: identification, age, origin, date of rash onset, date sample was taken, vaccination history, and date of last dose.
- National laboratories will send 100% of the positive and indeterminate cases, and a 10% random sample of negative sera to the reference laboratories for confirmation via the IgM Capture test.
- Given the need for reliable laboratory results, a more sensitive and specific indirect IgM test for measles diagnosis was recommended than the one currently used.

TABLE 1. Confirmed measles cases by country, Andean Region and Chile, 1993–1996.*

Country	1993	1994	1995	Clinically (1)	1996* Laboratory (2)	Total
Bolivia	3,391	1,441	76	6	0	6
Chile	1**	0	0	1	0	1
Colombia	9,851	639	308	10	3	13
Ecuador	3,627	3,668	919	20	0	20
Peru	1,730	670	353	60	1	61
Venezuela	22,231	16,561	172	27	3	30
Total	40,831	22,979	1,828	124	7	131

(1) Without adequate samples (failure of the surveillance system).
(2) IgM Capture test.
* Data as of 31 July.
** Imported.
Source: Country reports, 1996.

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Measles Laboratory Workshop in Central America

The directors of measles diagnostic laboratories of Central America met for the first time July 8-10 in Panama City. Representatives of laboratories in Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama, the director of the Regional Measles Reference Laboratory of Colombia, and SVI/PAHO staff evaluated their experiences during the first half of 1996.

The discussion focused on the role of laboratories in support of the measles elimination initiative in the Americas. Participants reviewed the results of laboratory diagnosis for measles in each of the countries, the measles laboratory diagnostic tests used in Central America, and the shipping and transportation of samples to the Gorgas Commemorative Center's Measles Reference Laboratory in Panama. Also, Panama's experience with measles surveillance was presented.

All the countries except Guatemala have begun the laboratory testing of sera from suspected measles cases using the indirect IgM assay.

The Gorgas Laboratory (CCG) had received and processed 216 samples as of week 26 of 1996, with 14 positives and 202 negatives. The positive cases are distributed as follows: Costa Rica, 4; El Salvador, 5; Guatemala, 1; Nicaragua, 2; and Panama, 2. The Gorgas Laboratory analyzed the samples received using the IgM Capture test, and sent to CDC all the positive samples and a certain percentage of the negatives (31 in all for 1996).

A response has been received for all 31 samples sent which points to an 88% agreement between the results obtained al the Gorgas Laboratory and those obtained at CDC. The positive cases were distributed as follows: Costa Rica, 4; El

TABLE 1. Samples and results of suspected measles cases sent by the countries to the Reference Laboratories, Central America, weeks 1 to 26, 1996.

Criterion		COR	ELS	GUT	HON	NIC	PAN
Cases with blood samples		198	237	100	8	162	73
Positives from national laboratories		33	13	...	0	8	2
CCG	Specimens sent	55	52	44	8	28	29
	+ for measles	5	5	1	0	2	2
	- for measles	50	47	43	8	26	27
CDC	Specimens sent	8	8	3	2	2	3
	+ for measles	5	4	1	0	0	1
	- for measles	3	4	2	2	2	2

Salvador 4; Guatemala 1; and Panama 1. The case from Guatemala had rash onset in 1995.

Of these positive cases, it was determined that 2 cases from Costa Rica, 3 from El Salvador, and 1 from Panama were vaccine-induced IgM.

Recommendations

- There was agreement on standardizing the indirect IgM test for all participating laboratories.
- The test should be performed weekly, except in special situations that justify increasing the frequency.
- Working relations between laboratory directors and directors of immunization programs should be strengthened in each country. Meetings for coordination and c1assitication of cases should be documented.
- Laboratories will process all the samples from suspected measles cases; in special cases, tests will be performed on samples that have diagnoses compatible with measles cases.
- The countries' laboratories will send to the Gorgas Laboratory samples of positive and indeterminate cases weekly and a 10% random sample of negative seta, monthly.
- Samples will be sent to the Gorgas Laboratory Mondays and Tuesdays with prior notice and confirmation that they are accompanied by the following information: Identification number, case name, age, date of rash onset, date sample was taken, date of last measles vaccination, and result obtained.
- The Gorgas Laboratory will provide instructions for sending samples and a sheet with the minimum data required with each sample.
- The Gorgas Laboratory will send the results to the countries one week after receiving the samples. They will be sent directly to the laboratories and through the PAHO Country Office in Panama to the national chiefs of EPI.
- In order to analyze the sensitivity and specificity of the indirect IgM test, all the countries will send to the Gorgas Laboratory the results of the indirect IgM tests obtained from January to June 1996. These findings may indicate a need for additional, more reliable tests.
- On a monthly basis the reference laboratory of the Gorgas Laboratory will send the countries a summary of the conditions samples are received (quantity, labeling, cold chain, minimal data, timeliness of reception).
- All the laboratories of the network should have a computer and modem capability.
- Efforts should be made to improve surveillance, so that all suspected cases enter the surveillance systems, not only suspected cases with serum samples.

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Record Five Years Measles-Free!

The Thirteenth Meeting of the Caribbean EPI Managers, held in Miami Beach, Florida from 4-6 November, brought together over 65 health officials from 19 countries of the English-speaking Caribbean and Suriname. Representatives from the French Departments of Guadeloupe and Martinique and from The Netherlands Antilles. Also present were health officials from Haiti, Canada's Laboratory Center for Disease Control, England's Department of Health, the United States' Centers for Disease Control and Prevention, Los Angeles and Dade Counties' Departments of Health, the Caribbean Epidemiology Center (CAREC), UNICEF, as well as technical staff from SVI/PAHO.

The English-speaking Caribbean continues to hold the longest record in the Western Hemisphere of five years without measles. Discussions focused on the build-up of susceptible persons and actions needed to prevent the re-introduction of the disease. Considerable time was also devoted to assessing the current situation of rubella virus circulation and congenital rubella syndrome (CRS) in the Caribbean. There was a consensus among participants on the need to raise awareness particularly among women and the countries' government officials, on the seriousness of this disease. Emphasis was placed on determining the critical elements for an effective strategy to control/eliminate rubella and CRS. As part of this effort, each country performed its own cost-benefit analysis of the immediate elimination of rubella/CRS by a mass campaign with rubella-containing vaccine. This analysis should serve as a baseline for further refinement of country-level.

Measles Eradication

During the 1992-1996 period, there has been no laboratory confirmed indigenous measles transmission, despite intensive surveillance and the investigation of 1.453 suspected measles cases. The level of measles vaccination coverage ranged from 75-86%. The last two confirmed cases were reported from Barbados in August of 1991. Over 270 cases have been discarded as rubella, 58 as dengue, and 1,125 have been discarded with other diagnoses. CAREC's Laboratory investigated 334 suspected measles cases in 1995, reported from 16 CAREC member countries. Jamaica had the highest number of suspected measles cases in 1995 due to a rubella epidemic. Dominica and Turks and Caicos also had relatively high numbers of cases due to a dengue epidemic.

Virtually all countries in the sub-region have already implemented PAHO's three step strategy for measles eradication. Follow-up campaigns have been carried out in 14 of the 19 countries. Five countries have not implemented the follow-up campaign as yet. Suriname is waiting for vaccines and plans to conduct a follow-up campaign in 1997. Trinidad and Tobago has decided to conduct a mop-up campaign for low-coverage and hard-to-reach areas, and the need for a follow-up campaign is being evaluated. Bermuda, Bahamas and Cayman Islands are not planning a follow-up campaign at this time. Countries continued to work toward reaching the measles eradication target of 95% measles vaccination coverage.

Since launching the Measles Elimination Surveillance System (MESS) on September 28, 1991 through December 31, 1995, there had been 223 weeks of reporting. During that time, most countries exceeded the target of 80% completeness for weekly reports (Figure 1).

Responding to the feedback received from the recent measles surveillance evaluations in the Americas, the English-speaking Caribbean has analyzed the quality of the case reporting forms. While performing generally well, areas to be strengthened included: more detailed information regarding the presence or absence of conjunctivitis, coryza or cough, vaccination history, dates of the last vaccination and the patient's address.

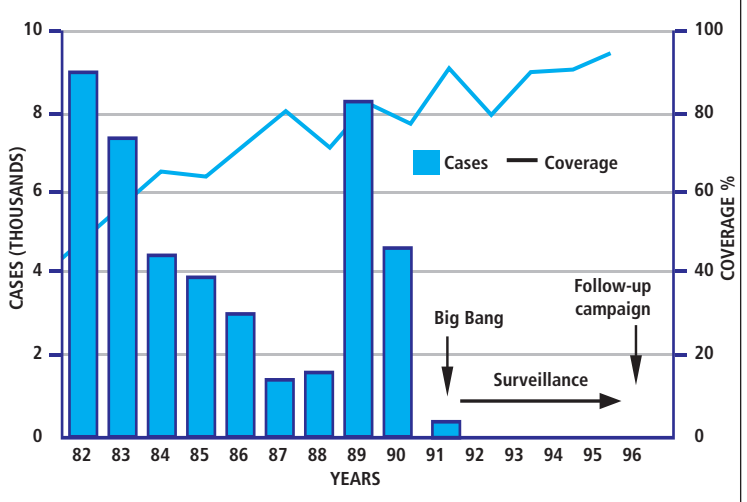
In the absence of measles cases, key indicators of population susceptibility are vaccination coverage and the accumulation of susceptibles, who either were not vaccinated or who have experienced primary vaccine failure.

Importations are the only way measles can re-emerge in the region. Given the high volume of tourists every year, there is concern that if follow-up campaigns are not conducted, particularly in Trinidad and Tobago, there is a high risk of an outbreak, which could threaten the other countries as well. A follow-up campaign was strongly recommended for that country.

Health officials at the meeting were reminded of the need to mobilize health workers to actively search and investigate every case of AFP. Re-sensitization of clinicians and public health staff about the importance of prompt investigation reporting and active surveillance will be key until global polio eradication is achived. Similar to measles surveillance, efforts to incorporate new reporting sources, such as non-governmental organizations, private physicians, and community groups will further strengthen surveillance.

Immunization coverage was mainatained at previous high levels. However, it was reported that in some countries coverage had either dropped or remained stationary under the 90% mark. When coverge is less than 95%, there is a considerable number of unvaccinated children. Measures should be taken to trace these children and ensure that they receive the needed vaccines.

FIGURE 1 Measles cases, 1982-1996, English-speaking Caribbean.



Source: Country Reports to CAREC.
BIG BANG - 1991 Mass Vaccination Campaign, 9 mo.-14 yrs.
Follow-up Campaign: 1-5 yrs.

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Measles Surveillance in Nicaragua

The evaluation of the measles epidemiological surveillance system in Nicaragua was led by a team from the Ministry of Health, with the support of PAHO/SVI. The methodology developed by PAHO/SVI for rapid analysis of measles surveillance systems was utilized to determine the capacity of Nicaragua's surveillance system to effectively detect the circulation of measles virus in all parts of the country.

During the month of August, 1996, four groups organized visits and conducted structured interviews with health teams at various levels—national, SILAIS,* and municipal—and placed priority on high-risk areas. The evaluation team conducted visits to the National Office of the EPI (Ministry of Health), the National Office for Epidemiological Surveillance (Ministry of Health), the National Diagnostics and Reference Center, two national reference hospitals, 17 directing teams at the SILAIS, 16 departmental hospitals, and 29 municipal health units. The evaluation focused on aspects of management, the surveillance process, and intensive surveillance in high-risk areas.

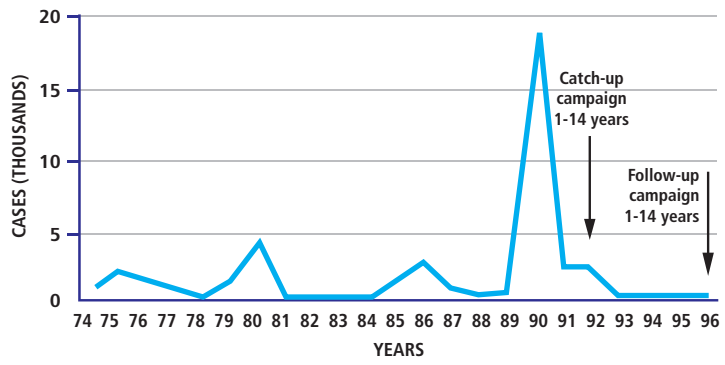
Results

In 1995, Nicaragua reported 195 suspected measles cases. Of these, 190 were discarded and five were clinically confirmed, indicating a failure of the surveillance system. In 1996, as of epidemiological week No. 31 (week ending 3 August), 194 suspected cases of measles had been reported, 193 of which were discarded. The number of reported suspected cases varied by SILAIS.

The distribution of suspected cases by age group is as follows: thirty-eight percent less than 1 year of age, 28% from 1 to 4 years, 21% from 5 to 14 years, and 12% over 15 years of age. The vaccination history of the 194 suspected cases is as follows: twenty percent had received one dose of measles vaccine, 30% two or more doses, 43% were not vaccinated, and in 7% of the cases the history was not known. Regarding the group that had not been vaccinated, 87% were under the age for vaccination.

The evaluation included an active search for suspected measles cases, which involved reviewing a total of 77,934 diagnoses and patient registers from medical consultations and emergency services in different hospitals and health centers for the period from January to August 1996, as was the investigation forms for suspected measles cases available at the units visited. Of these, only 95 case files merited further analysis to determine whether they were suspected measles cases not detected by

FIGURE 1 Confirmed measles cases by year, Nicaragua, 1974–1996.*



Source: EPI/Ministry of Health.
* Data as of 3 August.

the surveillance system. Only three were considered cases that should have entered the system; they are being investigated at this time.

The National Immunization Program has a computerized database (Measles Elimination Surveillance System) for suspected measles cases which evaluates the following surveillance indicators:

- Percentage of units with weekly negative notification: 98%
  The epidemiological surveillance network is made up of 175 reporting units, 23 hospitals and 152 health centers. The weekly negative notification reports are transmitted by a communication network that allows for a fast flow of information among the local level, the SILAIS, and the central level.
- Percentage of cases reported within 7 days of rash onset: 90%
  Sixty-one percent of the cases are reported within three days of rash onset, and 29% between the fourth and seventh days.
- Percentage of cases investigated within 48 hours of notification: 92%
  Of the 17 SILAIS, 15 investigate more than 90% of their cases in the first 48 hours.
- Percentage of cases with complete investigation and adequate sample taken: 100%
  For each case an investigation form is filled out. In 100% of the cases the following information is shown: name, age, SILAIS, municipality, date of rash onset, type of rash, fever, date samples taken, final diagnosis, and vaccination history. Seventy-four percent of the samples are taken in the first seven days following rash onset, 18% from the eighth to fifteenth day, and 8% after 15 days.
- Percentage of cases with laboratory results within 7 days: 36%
  On average, the results are reported 34 days after they are received. Of the samples, 60% are received in the laboratory within the first seven days after they are taken, and 21% between seven and 14 days. In addition, the national laboratory exercises quality control over the samples, evaluating the quantity, conservation, labeling, and information on the case investigation form.

Surveillance

The reporting system and communication network are optimal, and active local epidemiological surveillance exists through field visits. The database of the National Immunization Program is also used for periodic analysis for the identification of risk areas. Health staff know how to identify measles cases and understand the importance of immediate notification of a suspected measles case.

More than 90% of cases entering the surveillance system have been investigated in a timely fashion. There is an amplified case investigation form and a standardized format for documenting actions taken. There is a timely response to the detection of suspected measles cases.

The national laboratory has the resources and technical competence to perform the diagnoses. There is good coordination between the laboratory and the program at the central level. The system for collecting, conserving and sending samples is adequate at all levels, and the coordination between the national laboratory and the Regional Reference Laboratory of the Gorgas Commemorative Center has improved substantially.

Recommendations

- Strengthen and promote the clinical aspects for differential diagnosis of measles in training activities.
- Include alternative sources of reporting (schools, non-governmental organizations [NGOs] and private physicians) at all levels, registering them in the case investigation form.
- Promote and disseminate nationwide simplified standards for epidemiological surveillance.
- Do not exclude cases without samples from the surveillance system.
- The SILAIS should ensure adequate recording of basic information on the case investigation form.
- Document and strengthen the investigation of the source of infection.
- Take one blood sample at first contact with each suspected measles case.
- Review procedures and actions for responding to the presence of suspected measles cases.
- Each case should have a final classification within four weeks of being reported.
- A computer system should be installed at the central laboratory to facilitate case analysis.
- Establish a flow for timely and complete forwarding of the laboratory results to the SILAIS.
- Computerize the surveillance database at the SILAIS.
- Perform integrated analyses of available information on surveillance, coverage, and quality control at the SILAIS.
- Perform monthly monitoring of the surveillance indicators in each SILAIS.
- Publish and distribute the EPI epidemiological bulletin.
- Properly apply criteria for identifying risk areas based on local conditions, and strengthen surveillance in these areas.

Management

At all levels the political commitment is well-documented and the program is recognized as a health priority. Efforts have been made to increase and maintain high measles immunization coverage. There is active support from the Inter-agency Coordinating Committee (ICC) and the process of incorporating the private sector into surveillance and immunization activities has begun at the central level. The program has sufficient human and material resources, and health staff is motivated toward reaching the goal of measles eradication. Regular training and supervisory activities are well underway at all levels. The goal and strategies for measles eradication are known, and there are appropriate standards and technical documents for measles surveillance.

Recommendations

- Strengthen the managerial capacity for epidemiological surveillance in the various SILAIS and municipalities.
- Form a National Commission for Epidemiological Surveillance.
- Strengthen inter-institutional coordination with NGOs and private physicians in the SILAIS and municipalities.
- Seek mechanisms to further involve the national level, SILAIS, hospitals, and municipalities in the measles eradication initiative.
- Designate a person on a full-time basis to monitor the initiative's progress in all the SILAIS and municipalities.
- Allocate resources for transportation to ensure measles surveillance activities at all levels.
- Review the management and maintenance of the cold chain at the national level and in the SILAIS.
- Establish a system for merit recognition to keep staff motivated.
- Review the training methodology for the measles eradication effort and adapt it to municipal needs.
- Involve health workers from hospitals, the private sector, and community organizations in training.
- Provide education and training on information analysis and quality control.
- Systematize and document supervisory activities for follow-up at all levels as a form of in-service training.

Conclusions

1. There is an active epidemiological surveillance system at the national level capable of detecting suspected measles cases or outbreaks on a timely basis.
2. The lack of laboratory confirmed cases is an indicator of the effectiveness of the vaccination strategies used by the country to eradicate measles, and of the optimal levels of coverage attained.
3. There is no evidence of measles virus circulating in the country.
4. In order to maintain the successes attained, it will be necessary to involve other public and private sector institutions, schools, and community organizations.

* SILAIS: local health systems.

1997

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Measles in Brazil: Indigenous or Imported?

On 24 September 1996, the Santa Catarina State public health department received a report of a suspected measles case. The patient was a 32-year old woman from São José County who had been seen by a physician on 22 September 1996 because of fever, rash and cough. She was initially thought to have an allergic reaction and was treated with antihistamines.

Two days later, the patient returned for re-evaluation accompanied by her 6-month old grandson, who was acutely ill with a fever and rash illness. The infant was referred to a pediatrician and was diagnosed clinically as having measles. The woman's rash had increased in severity and her respiratory

Acknowledgements

We recognize the unrelenting efforts of the legion of health workers in the Americas: who by virtue of their efforts have made it possible to collect in each of these articles the experiences and best practices accumulated by the Region to eliminate measles, rubella and congenital rubella syndrome. We also thank the immunization team in the regional office, immunization focal points, and national immunization professionals in each country who contributed ideas, time and talent for the original production of these articles. Finally, we would like to thank all the people of the Americas for their determination in making this continent a healthier place.

symptoms had worsened. She was then hospitalized with the diagnoses of measles and pneumonia.

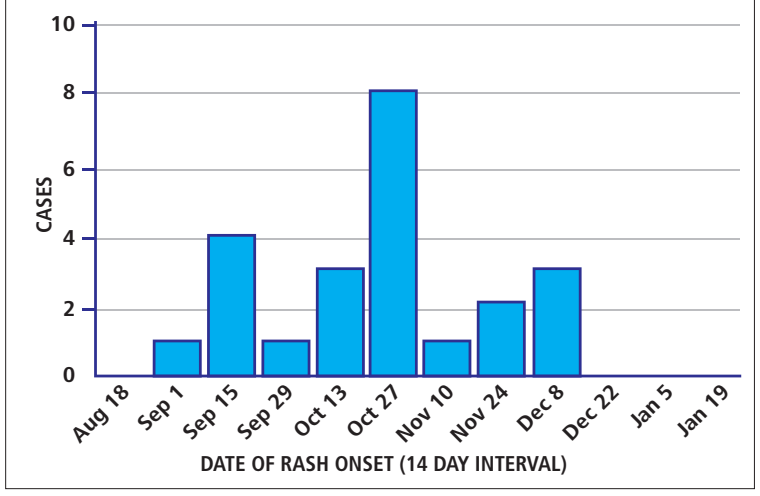
Both cases were confirmed as measles when serum specimens tested positive for measles IgM antibodies using an indirect assay at the Public Health Laboratory (LACEM) in Florianópolis. The specimens were later reconfirmed using the highly specific measles IgM capture test in the measles laboratory of the Oswaldo Cruz Foundation (FIOCRUZ) in Rio de Janeiro.

A visit to the woman's home revealed that her 19-year old son-in-law, a gas station attendant, had a history of fever and rash illness, with rash onset on 6 September 1996. A blood specimen collected from him in late September was positive for measles IgM antibody. The source of his measles infection is unknown.

Field investigation conducted in the Florian6polis health district, including 18 counties of Santa Catarina between September and December of 1996, ascertained a total of 58 suspected measles cases (Figure 1). Of these, a total of 24 (41.4%) were confirmed as measles, 23 via laboratory confirmation and 1 case was confirmed by epidemiologic linkage to a laboratory confirmed case. The remaining 34 suspected measles cases had a blood specimen collected and tested negative for measles IgM, and were thus discarded. The last confirmed case had rash onset on 18 December 1996. No additional cases have been detected since then, despite the existence of enhanced measles surveillance.

Urine specimens were collected for measles virus isolation from several suspected measles cases. These specimens were centrifuged, resuspended in viral transfer media, frozen and transferred to the FIOCRUZ measles laboratory. Measles virus was isolated from two of the submitted specimens. Genomic analysis of the measles virus isolates is currently being conducted in collaboration with the Centers for Disease Control and Prevention's measles laboratory in Atlanta, Georgia, USA. Provisional data of the nucleotide sequence of the isolated virus suggests that the virus isolated from Santa Catarina is similar to a virus which has been circulating in Europe in recent years, suggesting the likelihood of an importation.

FIGURE 1 Confirmed measles cases, Santa Catarina, Brazil. August 1996–January 1987.



Thirteen confirmed cases were reported from São José County, 4 from Antonio Carlos County, 2 from the capital city of Florianópolis, and one case each from Biguaçu, Palhoça, Aguas Mornas, Criciuma and Brusque Counties. Of the laboratory confirmed cases, 4 (17.4%) had histories of measles vaccination; the remaining cases were unvaccinated. Of the confirmed cases with histories of measles vaccination, 2 (50%) had received measles vaccine in the month before rash onset.

Cases ranged in age from 6 months to 32 years. Seven cases were younger than one year of age, three cases occurred in children 1-9 years of age, seven cases were in children 10-19 years of age and seven cases occurred in persons ≥20 years of age. In the Florianópolis health district, the highest age-specific attack rates occurred in infants <1 year of age (42.8 cases/100,000 population), in adolescents 15-19 years of age (7.4 cases/100k) and in young adults 20-29 years of age (4.5 cases/100k).

Outbreak response activities included an emergency review of vaccination coverage in the affected counties, provision of measles vaccine to infants and children without histories of measles vaccination and enhanced measles surveillance. In addition, a technical team was sent to Antonio Carlos and São José Counties, where visits were made to the households of all confirmed measles cases to gather further information on the possible source of infection and to find additional cases. Visits were also made to health centers, hospitals and schools in these counties to provide measles vaccine to unvaccinated children and to stimulate measles surveillance.

A technical meeting was convened for personnel from the Florianópolis District and Santa Catarina health departments to obtain further information. A lecture was given for pediatricians and pediatric residents at the Children's Hospital in Florianópolis to inform them about the plan to eradicate measles from Brazil and the need to report any suspected measles cases.

Analysis of the coverage attained in the 1992 catch-up vaccination campaign aimed at children 1 to 14 years of age, and in the 1995 follow-up campaign among children from 1 to 3 years old, indicates that at the state level overall coverage was 94.2% in 1992, and 85.2% in 1995. In 1992, coverage of the group aged 10 to 14 years was 85.3%. Measles vaccination through routine health services between 1992 and 1995 reached 90% of the children under 1 year of age.

It can be estimated that the number of susceptible individuals born after 1992, between those not vaccinated (5% to 10%) and those vaccinated but not immunized (also 5% to 10%), comes to approximately 10 to 15% of all children born (105,000 a year), or 40,000 to 60,000 children aged 1 to 4 years in 1996, many of whom may actually have been revaccinated during the follow-up campaign of 1995. Given the coverage levels attained in the 1992 campaign among the group aged 10 to 14 years, it is also estimated that as many as 75,000 adolescents between 14 and 20 years old in the state, may also be susceptible to measles.

The confirmed cases in São José County were clustered in a poor peri-urban area. This led to a selective vaccination effort, in which 14 children from 9 months to 14 years of age living in the area were found to be unvaccinated. In the municipality of Antonio Carlos selective vaccination efforts were undertaken after each report of a confirmed measles case. This included a review of immunization of the

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Presenting Evidence and Sharing Best Practices for Elimination Initiatives

The best way to understand how a disease can be eliminated is to observe the actions of those who worked to eliminate it and read what they wrote about it. This compendium of rubella and congenital rubella syndrome (CRS) articles is a collection of articles on evidence and best practices in measles, rubella, and CRS elimination, written by the health workers themselves. Since 1979, the *EPI Newsletter*—today know as the *Immunization Newsletter*—has published lessons learned, critical evaluations of the results achieved by the interventions and of the data obtained, and investigation findings. An essential aspect of the *Immunization Newsletter* is that it has allowed the dissemination of experiences to other countries and future generations. This is of prime importance because without being written about and disseminated, those experiences would have been in vain.

Over the fifteen-year period of the measles and rubella elimination process, while recommended strategies were implemented in a time of rapid and dramatic changes, all the countries had to be tuned in to the same frequency. It was an ever growing challenge in light of the cultural, religious, and social diversity in the Region, but the daily and steady advances of the disease elimination initiatives were a means to unite us all. In addition, countries worked hand-in-hand in a show of Pan-Americanism: a close bond and a tight solidarity between a brotherhood of countries. The book provides a response to questions regarding development and implementation of strategies, alternatives considered, challenges, and results.

The importation of measles and rubella cases will continue to pose a threat to elimination programs. Although extraordinary efforts are being made, virus importations will continue. They will only be stopped when countries of the other regions of the world conduct similar efforts. Today, as we reach the end of the 21st century's first decade, the feasibility of global measles eradication is being discussed. It will only become possible if appropriate strategies are implemented. With this in mind, this publication will represent a precious source of knowledge for other regions of the world.

We cannot write about disease elimination without mentioning the impact these initiatives have on renovating and strengthening primary health care. The need to achieve universal coverage in order to attain measles and rubella elimination contributes to the

Editorial Note:
The outbreak in Santa Catarina is the largest that Brazil has experienced in over 2 years. In 1995, only 13 laboratory-confirmed cases of measles were reported in Brazil. In 1996, prior to this outbreak, only 3 laboratory confirmed cases had been reported, two of which are believed to have been imported from Japan and Italy, respectively. In contrast, in 1991 the year prior to the catch-up campaign, over 30,000 measles cases were reported in Brazil.

The initial information from the outbreak investigation suggests that important changes have occurred in the epidemiology of measles in Brazil. Until very recently, measles was circulating freely in Brazil and thousands of cases were reported each year. Moreover, the country experienced major measles outbreaks every few years, with tens of thousands of cases, when the number of susceptible children accumulated to high levels. Most cases occurred among unvaccinated infants and preschool-aged children.

As a result of the implementation of PAHO's measles eradication strategy, measles virus circulation appears to have been interrupted throughout Brazil. Indeed, prior to this outbreak, the last confirmed case of measles in Santa Catarina State was reported in 1993.

While measles surveillance can not be expected to detect every case of measles virus infection in Santa Catarina, in historical comparison, measles transmission does not appear to be extensive. Most cases in this outbreak are occurring among unvaccinated infants, adolescents and young adults. Preschool-age and school-aged children have largely been unaffected by the outbreak. This demonstrates the ability of measles virus to seek out susceptible individuals, even in areas which have achieved and maintained high levels of population immunity.

The source of the outbreak remains unknown, but the genomic analysis of measles virus isolated from the outbreak investigation suggests that measles virus may have been imported into Santa Catarina from Europe. This finding underscores the ability of measles virus to readily travel between continents and to cause outbreaks in areas which had previously interrupted measles virus circulation. The recent report of an outbreak in the Philippines is a cogent example of the dangers that measles poses.

Since early January 1997, 59 children have died from measles in the Philippines, with most cases and deaths occurring in the Manila metropolitan area. All deaths occurred in infants and children 5 years of age and younger. Furthermore, over 1,000 children were hospitalized in the Manila area and about 200 children in other parts of the country due to complications of measles infection.

As long as measles virus is circulating anywhere in the world, Brazil and the other countries of the Americas will remain at risk for importations of measles virus. The only effective way to totally prevent importations into measles free countries will be through the ultimate global eradication of measles. As other regions of the world learn from PAHO's measles eradication experience, global measles eradication will increasingly be seen as being an attainable goal.

500 students attending the local school. Few previously unvaccinated students were found. Selective vaccination was also conducted among the contacts of the subsequently reported and confirmed cases.

Source: Carla Santos Domingues-MOH Brasilia, Ilse Lisiane-MOH Santa Catarina, Marilda Siqueira-FIOCRUZ, Elisabeth David dos Santos- MOH Brasilia,Bernardus Ganter-SVI/PAHO, Brasilia.

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Measles in the United States, 1996

As of December 30, 1996, local and state health departments had reported a provisional total of 488 confirmed cases of measles to the Centers for Disease Control and Prevention (CDC) for 1996, and the Commonwealth of Puerto Rico had reported eight cases (Figure 1). In addition, indigenous transmission of measles in the United States was interrupted for a prolonged period beginning in late 1996. This report summarizes measles surveillance data for 1996, which indicate that a substantial proportion of cases were associated with continued international importations of measles and outbreaks among school-aged children who were not required to receive a second dose of meas1es-containing vaccine (MCV) to attend school.

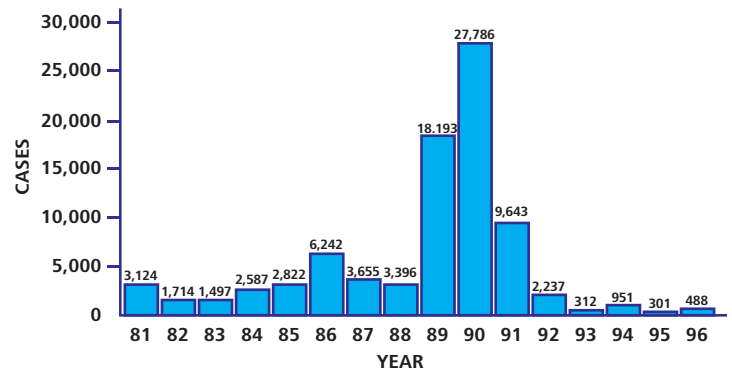
Of the 488 provisional cases, 355 (73%) were indigenous to the United States. International importations accounted for 47 (10%) cases of measles, and an additional 86 (18%) cases were epidemiologically linked to imported cases.

Importations originated from or occurred among persons who had traveled in Germany (seven cases); Greece and Japan (five each); Austria, India, and Philippines (three each); China, Italy, and Russia (two each); and England, Kenya, Liberia, Nepal, Somalia, Tahiti, and Turkey (one each). For eight of the imported cases, the exact source was unknown, because the patient had traveled in more than one country outside the United States during the exposure period. None of the imported cases were acquired in countries in the Americas.

Age and Vaccination Status

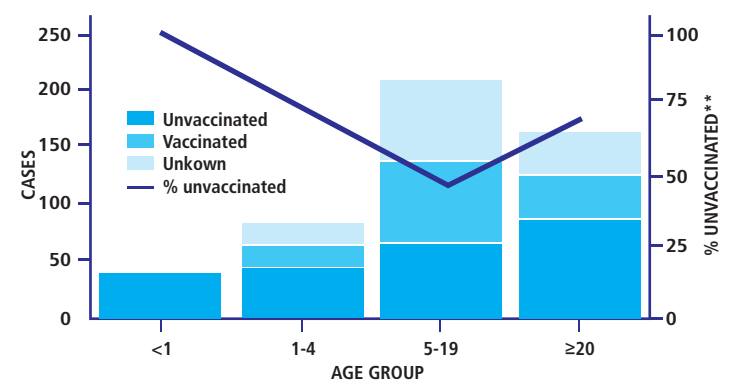
Of the 465 measles patients for whom age was known, 117 (25%) were aged less than 5 years, including 37 (8%) aged less than 12 months and 25 (5%) aged 12-15 months. A total of195 (42%) measles patients were aged 5-19 years, and 153 (33%) were aged greater than or equal to 20 years. Vaccination status was reported for 354 patients (Figure 2). Of the 226 (64% of the total cases) who were not vaccinated, 170 (75%) were eligible to be vaccinated (i.e., aged greater than 12 months and born after 1956). Vaccination status varied by age group; all 32 patients less than 1 year were unvaccinated, compared with 44 (71%) of 62 patients aged 1-4 years, 65 (48%) of 136 patients aged 5-19 years, and 85 (69%) of 124 patients aged greater than or equal to 20 years.

FIGURE 1 Measles in the United States, 1981-1996.*



* Provisional data for 1996.
Source: CDC.

FIGURE 2 Age distribution and vaccination status of reported measles cases, United States, 1996.*



* Excludes 23 cases with unknown age.
** Percent unvaccinated among cases with known vaccination status.

Outbreaks

Twenty-three outbreaks (i.e., clusters of three or more epidemiologically linked cases) were reported by 15 states, accounting for 76% of all cases. The number of cases associated with outbreaks ranged from three to 121 (median: five cases). Transmission of measles occurred in school settings in seven outbreaks, and these outbreaks accounted for 55% of all eases reported in 1996. In four outbreaks (Alaska, Texas, Utah, and Washington), cases among school-aged children occurred primarily in those who had received only one dose of MCV; in two other outbreaks (Massachusetts and Minnesota), cases occurred among school-aged children who had religious or philosophic exemptions to vaccination. In Hawaii, an outbreak occurred in a college without vaccination requirement.

The source case for six outbreaks (California, Hawaii, Massachusetts, New York, Pennsylvania, and Washington) was traced to an international importation. Genomic sequences from measles virus isolates from four outbreaks without an identified source case (Alaska, Massachusetts [different from the outbreak listed above in Massachusetts], Minnesota, and Utah) were similar to sequences from viruses that were identified as importations from Europe and Southeast Asia. This suggests than an additional 205 (42%) of the 488 provisional cases reported for 1996 were related to international importations.

With the exception of an outbreak of measles in Hawaii (which was linked both by case

promotion of universal access to immunization. In the process, the inequities, the exclusion, and the health inequalities that still persist, and result from economic, linguistic, cultural, and gender barriers, are reduced.

Elimination strategies also strive to expand the offer of services to overcome the gap in coverage that remains a reality for many countries where large portions of the population continue to be neglected. These strategies also place the individual at the center of health care services and offer efficiencies of scale, since comprehensive care and integration of health interventions are the only viable options when countries are facing concurrent problems, such as disasters or outbreaks.

The strengthening of inclusive leadership, one that permits strong consensus-building among various stakeholders prior to strategy implementation, has been essential to measles, rubella, and CRS elimination. The leadership has allowed for the elimination initiative to count on the involvement of scientific societies, public, private, and community organizations, and churches. It has drawn cooperation from all sectors of society and has promoted new models of collaboration.

By taking advantage of the impetus of disease elimination initiatives, we can accelerate health system transformation and renovate primary health care, while drawing on the principles of universal access, equity, and social justice.

This compendium of lessons learned and best practices seeks to promote the sharing of experiences between countries. It can provide an example to follow in the global health arena, as it highlights the benefits of uniting in collective action and calls for comprehensive and universal care, while identifying various financial mechanisms in support of global solidarity.

If the world is a book, then this compendium is one of its chapters: a new way to tell history and provide a testimony regarding a major milestone in global public health. We hope that this compendium will be a useful tool and that you will visit www.paho.org/immunization to learn more about the measles, rubella, and CRS initiatives in the Americas.

Editorial Note:
Similar to other countries in the Region, in 1996 the United States experienced a low level of measles virus circulation, and reported the third lowest total number of measles cases in the history of measles surveillance. Indeed, the 488 provisional cases reported in 1996 represent a 98% reduction compared to the nearly 28,000 cases reported in 1990 during the last major outbreak of measles in the United States. However, measles outbreaks continue to occur.

Of the total cases reported with known vaccination status in the United States during 1996, 64% occurred in unvaccinated individuals. Seventy-five percent of the unvaccinated cases were in the target age-group for measles vaccination, and of the cases occurring in preschool-aged children (1-4 years of age), 71% were unvaccinated. These data reinforce the fact that unvaccinated persons are always at highest risk for contracting measles. The high infectivity of measles allows the virus to seek out susceptible hosts, even in populations with high vaccination coverage.

Nearly 40% of total reported measles cases occurred among school-aged children (5-19 years of age). Of these, 52% were unvaccinated, many due to philosophical or religious objections to vaccination. The remaining cases among school-aged children were among vaccinated persons.

The occurrence of measles in persons with histories of measles vaccination is not unexpected. Measles vaccine effectiveness is less than 100%, meaning that 5-10% of persons do not become immunized to measles following vaccination. During a measles outbreak, susceptible, vaccinated persons may be exposed to the virus and develop measles. However, the risk of measles in a vaccinated person is clearly lower compared to that of the unvaccinated.

Analysis of data obtained from classic epidemiologic investigations, combined with information obtained from molecular epidemiology of isolated measles virus from reported measles cases suggest that importations may have been responsible for nearly 70% of the reported measles cases in the United States during 1996. The majority of imported cases appear to have originated from Europe and Asia.

None of the imported cases originated in the Region of the Americas. It has been over 2 years since the last measles case was imported from Latin America or the Caribbean into the United States. This provides further indirect confirmation of the remarkable progress the countries of the Americas are making towards achieving the goal of measles eradication by the year 2000.

To combat the occurrence of measles outbreaks among school-aged children in 1988, the United States adopted a routine two-dose measles vaccination schedule. During 1996, states which had not fully implemented this policy among all age cohorts of school-aged children were at greater risk for measles than those states which have assured that all school-aged children are vaccinated with two doses of measles-containing vaccine. The full implementation of this vaccination schedule is expected to greatly reduce the number of school-aged children with measles.

However, a two-dose measles policy is not an appropriate vaccination strategy for all countries. Unless nearly universal coverage can be obtained with the first dose of measles vaccine, the addition of a second dose will provide little benefit in preventing measles outbreaks. Indeed, most persons who receive a second dose of measles vaccine are already immune to measles, while the overwhelming majority of unvaccinated children are susceptible to measles and would be protected after receiving a single dose.

investigation and molecular epidemiology to international importations of measles virus), indigenous transmission of measles in the United States appears to have been interrupted in late 1996. From October 18,1996, to February 10, 1997 (16 weeks), only one case of measles (with rash onset on December 16) not linked to an international importation was reported in the United States. An indigenous case with rash onset in February is still under investigation.

Reported by: State and local health depts. Measles Virus Section, Respiratory and Enterovirus Sr, Div. of Viral and Rickettsial Diseases, National Center for Infectious Diseases; Child Vaccine Preventable Diseases Sr, Epidemiology and Surveillance Div, National Immunization Program, CDC.

Source: MMWR 46(11); 242-246; March 21, 1997.

April 1997
Volume XIX, Number 2

Update: Recent Measles Outbreaks in the Americas

Several outbreaks of measles have recently been reported in the Western Hemisphere-in Canada, Guadeloupe of the French West Indies and Brazil (Santa Catarina and São Paulo) during the past months. The June *EPI Newsletter* will discuss the situation in São Paulo.

Guadeloupe: The French department of Guadeloupe, located in the Caribbean, investigated 135 cases of suspected measles between November 1996 to March 1997. Eighty-five of these cases were confirmed by the presence of anti-measles IgM antibodies or via epidemiological linkage. The first cases were reported from the city of Saint François, the main tourist area of the island. Until early 1997, most cases were confined to this region, but by 15 February, the epidemic had spread to adolescents attending Petit Bourg high school and several surrounding middle-schools. The group most affected was children 10-19 years of age. The source of the outbreak appears to be a young child visiting the island from Europe. Molecular analysis of measles virus isolated from the outbreak found that the virus circulating in Guadeloupe was very similar to recent isolates obtained from Western Europe.

Control measures were implemented, with measles vaccination offered to all secondary school children in areas affected by the outbreak. Investigation of the outbreak is continuing.

Canada: Between 16 January 1997 through 1 April 1997, a total of 298 confirmed measles cases have been reported in the Province of British Columbia. The measles cases are concentrated at the Simon Fraser University campus located near Vancouver. Most cases are occurring among students 20-29 years of age, many of whom had been previously vaccinated with one dose of measles vaccine. There have been no known cases among individuals immunized during last year's second dose catch-up measles campaign. The source of the outbreak is unknown, and molecular analysis of isolated measles virus is pending.

Editorial Note:
These outbreaks provide further evidence on the changing epidemiology of measles in the Americas. In the pre-vaccine era, measles primarily affected infants and preschool-aged children. Large outbreaks would occur every 2-3 years, when the number of accumulated susceptible children was sufficient to sustain measles transmission.

As recommended by PAHO, most countries in the Region have conducted catch-up vaccination campaigns to assure high measles immunity among school-aged children. These vaccination activities have resulted in a substantial reduction in the circulation of measles virus in all countries of the Region, and a subsequent increase in the average age of infection. In the Americas, measles outbreaks now occur principally among older children, adolescents and young adults who have not been targeted for measles vaccination. These persons were often born too early for routine measles vaccination, yet too late to have been exposed to circulating measles virus. Many of these outbreaks can be traced to importations.

The high transmissibility of measles virus allows it to infect susceptible persons, even in areas with high measles population immunity. These recent outbreaks suggest that there may be many adolescents and young adults in the Region who remain susceptible to measles. Increased efforts are needed to assure measles immunity in these groups, especially those working or residing in high-risk environments, including secondary schools, colleges and health care settings.

Enhanced surveillance, careful investigation of suspected measles cases and the administration of measles rubella vaccine to persons thought to be susceptible are among the response activities being implemented. Persons born after 1956 without documentation of having received two-doses of measles vaccine are considered potentially susceptible to measles. Over 11,000 persons had been vaccinated in January, during the first week of the university-wide campaign. Attempts are being made to vaccinate all persons attending other post-secondary institutions in the Province, and to assure measles immunity among health care workers.

Sources: Dr. Max Theodore, DASD Conseil General de la Guadeloupe, Dr. Regis Goursaud, Institut Pasteur de Guadeloupe and Dr. Paul Varughese, Division of Immunization, BID, LCDC, Canada.

April 1997
Volume XIX, Number 2

Measles Vaccination and Guillain-Barre Syndrome

Background.

Guillain-Barre syndrome (GBS) has been associated with several infectious agents, and the possibility that the disorder may be caused by vaccination has been raised. We compared the numbers of cases of GBS observed immediately after mass measles vaccination campaigns with the numbers that would be expected from baseline rates, to assess whether there is a causal relation between measles vaccination and GBS.

Methods

We analyzed data on 2,296 cases of GBS reported to the Poliomyelitis Eradication Surveillance System of the Pan American Health Organization as cases of suspected poliomyelitis. These cases occurred among 73 million immunized children aged 9 months to 15 years in Argentina, Brazil, Chile, and Colombia, between January, 1990, and December, 1994. These children were targeted for mass measles vaccination campaigns (each lasting 1 month) in 1992 and 1993. The frequency of GBS cases observed during the vaccination campaigns or the next 42 days (the latent period) was compared with that during the rest of the study period, with the assumption of a Poisson distribution.

Findings

The average annual incidence of GBS was 0.62 per 100,000 children aged 1-14 years. The number of cases that would be expected within any 72-day period would therefore be 92. The average observed number of cases during the latent periods after measles vaccination was 97. The probability that 97 or more cases would occur during a period with an expected number of 92 was 0.31.

Interpretation

The average annual rates of GBS by age-group for the 5 years analyzed were consistent with previous data; thus we are confident that the surveillance system is sufficiently sensitive. There was no statistically significant association between measles vaccination and GBS. If there is any causal relation, the number of GBS cases due to measles vaccination was so small that data from the vaccination of more than 70 million children were not sufficient to detect a rise in the number of observed GBS cases beyond the expected number.

Source: da Silveira, C.M., Salisbury, D.M., de Quadros, C.A. Measles Vaccination and Guillain-Barré Syndrome. Lancet 1997; Vol. 349: 14-16.

Editorial Note:

The majority of vaccinations are administered during a child's first years of life. Therefore, any illness afflicting that child will likely occur within a short period of time following his/her most recent vaccination. This fact needs to be taken into account when determining the presence or absence of a causal relation between vaccines and adverse events. This argument is supported by the 1994 review of adverse events associated with childhood vaccines published by the Institute of Medicine (IOM). The study sought to make causal inferences about the relation between vaccines administered and several adverse health outcomes. Most of the impairments classified as adverse events of vaccination were discarded for lack of data and biological plausibility.

April 1997
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Argentina Introduces Hib and MMR Vaccines

In April 9, 1997, the Ministry of Health and Social Action of Argentina formally introduced the *Haemophilus influenzae* type b (Hib) vaccine and the combined live vaccine for measles, mumps and rubella (MMR) in the country's regular immunization program.

In the official text, the Ministry of Health mentions that Hib vaccine will prevent severe infections caused by this pathogen, such as meningitis and epiglottitis, which are highly lethal (5 to 8%), and can also leave sequelae like mental retardation and deafness (25 to 35%). The most affected group is between the ages of 2-28 months (35 to 40% of cases).

MMR vaccine is currently preventing three diseases (measles, mumps, and rubella) which can cause death and leave physical sequelae, some of them severe. In the case of rubella it will also protect against congenital rubella syndrome (CRS).

Source: Ministry of Health and Social Action, Argentina.

June 1997
Volume XIX, Number 3

Update: São Paulo Measles Outbreak

The last major measles outbreak in São Paulo state occurred in 1990. Since then, there has been relatively little measles activity in the state (see Figure 1). During 1996, a total of 22 confirmed measles cases were reported. To date in 1997, there has been a re-emergence of measles in São Paulo state with nearly 400 confirmed cases reported. The purpose of this report is to review the epidemiologic situation of measles in São Paulo.

In 1987, a mass vaccination campaign targeting all children 9 months through 14 years of age in the state was conducted using single-antigen measles vaccine. Reported coverage was over 90%. In 1992, a second mass vaccination campaign targeting children 1-10 years of age was conducted using MMR vaccine and coverage was over 90%.

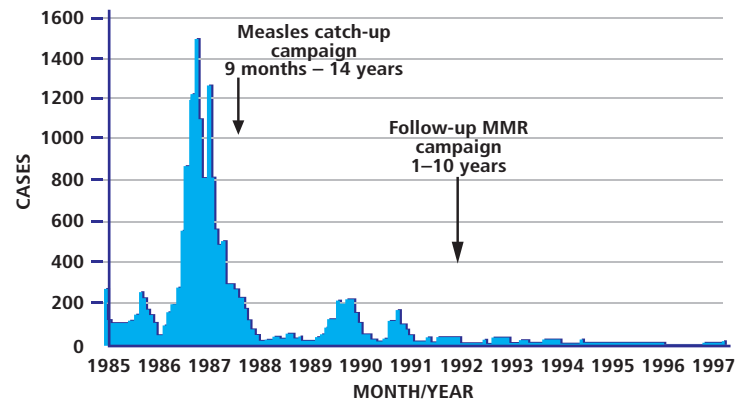
Following the second campaign, São Paulo state adopted a routine two-dose measles vaccination policy. Children are vaccinated at 9 months with single-antigen measles vaccine and are revaccinated with MMR vaccine at 15 months of age. A follow-up campaign has not been conducted.

Routine measles vaccination coverage in the Greater São Paulo area has been officially reported to be over 90% in 9 of the last 10 years. In the last five years, reported coverage with measles vaccine has been 98% or more. Since 1992, routine MMR coverage has been reported to be greater than 100% every year.

Preliminary outbreak investigation

Between 1 January 1997 and 30 May 1997, a total of 846 suspected measles cases were reported to the São Paulo

FIGURE 1 Confirmed measles cases by month,* São Paulo, Brazil, 1985–1997.**



* Cases reported through 4 June 1997.
** Until 1987, only hospitalized cases were notified.
Source: Center for Epidemiological Surveillance, São Paulo, Brazil.

Editorial Note:

After a virtual absence of about 6 years, measles virus is again circulating in São Paulo. This is among the largest outbreaks in recent years in the Americas. Although difficult to predict, this outbreak may approach or surpass the 1989 measles outbreak, when nearly 2,000 cases were reported in São Paulo state.

Contributing factors for this outbreak include: insufficient population immunity in children 1-4 years of age due to an inappropriate vaccination schedule, the presence of large numbers of susceptible young adults, high population density and introduction of measles virus.

As discussed previously, a two-dose vaccination strategy is not sufficient to eradicate measles, especially when the vaccination coverage is less than 100% for both doses and population density is high. Moreover, the reported vaccination coverage data in São Paulo appear to have grossly overestimated true coverage, due to an underestimation of the population size.

There are approximately 400,000 measles susceptible children 1-4 years of age in Greater São Paulo. Transmission in this age-group may be fueling measles transmission among infants <1 year of age and susceptible young adults.

According to the PAHO measles eradication strategy, a *follow-up* measles vaccination campaign should be conducted when the number of susceptible preschool-aged children approaches one birth cohort. Therefore, a *follow-up* campaign should have been conducted among children 9 months through 4 years of age in 1995. This was not done in São Paulo.

Such a campaign could have prevented this outbreak, or at the least, would have greatly reduced the number of susceptible preschool-aged children and would likely have reduced the probability of experiencing so large an outbreak.

In addition to susceptible, preschool-aged children, there is apparently a large number of susceptible young adults living in São Paulo. These are persons who are both unvaccinated and have never experienced measles infection. Many of these persons are in the age-group which was targeted for vaccination during the 1987 mass vaccination campaign. A working hypothesis is that the outbreak is occurring primarily among unvaccinated young adults who have recently migrated to São Paulo from other parts of the country. This hypothesis is currently being investigated.

Outbreak prevention is always preferable to outbreak response. Measles outbreak control is very difficult, if not impossible, especially when measles virus is circulating widely. Measles virus spreads far faster than outbreak response vaccination activities. Therefore, the planned selective vaccination campaign is unlikely to have any major impact on measles virus circulation in São Paulo. A *follow-up* campaign targeting all children 6 months to 15 years of age would seem more appropriate under the present circumstances. Further updates of this important outbreak will be included in future issues of the *EPI Newsletter*.

In Haiti, as in the rest of the Hemisphere, the measles eradication initiative requires partnerships at all levels of society.

Secretariat of Health. Of the reported cases, 383 (45.3%) cases have been laboratory confirmed, 127 (15.0%) have been discarded after laboratory testing, and 336 (39.7%) remain under investigation.

There has been a major increase in reported suspected measles cases during the months since March, 1997. In May, nearly 400 suspected measles cases were reported. The Greater São Paulo metropolitan area has been primarily affected by this outbreak. The highest measles incidence rates have been reported in the municipality of São Paulo and the surrounding areas of Greater São Paulo. Few cases have been reported from other parts of the state.

Confirmed measles cases have ranged in age from 2 months to 44 years of age. Over half of the reported cases have been among persons 20-29 years of age (born between the years 1966 and 1978) and 18% have been in children under 1 year of age. Highest age-specific attack rates are in infants <1 year of age, followed by adults 20-29 years of age and children 1-4 years of age. The majority of the young adults were born between the years of 1964 and 1978. Unvaccinated infants and young adults appear to be at highest risk for measles infection.

Transmission has been documented in medical settings. Several young adult health care workers have been confirmed with measles. Transmission has occurred from health care workers to patients and from patients to health care workers.

Measles virus has been isolated from clinical specimens collected from several measles cases by the Instituto Adolfo Lutz. Genetic analysis of these isolates will be performed at the measles laboratory of the Centers for Disease Control and Prevention in Atlanta, Georgia, USA. This information may provide important clues as to the source of the virus which is causing the São Paulo outbreak.

After reviewing available data, an advisory panel organized by the Secretariat of Health has recommended that a "selective" measles vaccination campaign be conducted among children 9 months through 4 years of age to stop the outbreak. This campaign was scheduled to begin on 21 June 1997.

Source: São Paulo State Secretariat of Health, Division of Epidemiology; Instituto Adolfo Lutz, Department of Virology.

June 1997
Volume XIX, Number 3

Natural Gas Company Supports Measles

Trinidad and Tobago received financial and logistical support during the month of May for their follow-up measles vaccination campaign from the Atlantic Liquid Natural Gas Corporation (Atlantic LNG). Atlantic LNG launched the program "Atlantic for Children" to help promote the well-being of children in the country. The financial contribution in the amount of TT$ 450,000 (approximately US$ 72,000) will be used to carry out a media campaign, to sponsor medical teams in the delivery of vaccines in hard-to-reach areas, and to support record-keeping activities. Atlantic LNG has also committed a vehicle equipped with a public address system and driver to transport the medical teams.

Source: Ministry of Health, Trinidad and Tobago.

Editorial Note:

The support provided by Atlantic LNG represents the kind of partnerships between the public and private sectors that should be emulated or strengthened throughout the Americas. Today and future disease elimination goals and their maintenance will require the collaboration of all sectors of society.

August 1997
Volume XIX, Number 4

Target 2000: Measles Eradication in the Americas

The world health community is again paying close attention to the new challenge of measles eradication in the Americas by the year 2000. Despite the availability of an effective vaccine, approximately one million children worldwide still die annually from measles and countless others have permanent sequelae from measles infection, the great majority of whom live in developing countries under crowded urban conditions.

Measles transmission has been interrupted in major portions of the Americas. As recently as 1990, there were over 240,000 cases of measles in the Americas. By 1995, the number of confirmed cases had gone down to 6,489 and to 2,109 in 1996. The vaccination strategies recommended by PAHO in the Americas are being considered by several countries in Africa and Asia, where measles continues to be a considerable health burden.

The many health challenges today call for heightened collaboration. Increased international travel is bringing everybody closer to infectious diseases in distant places, and these diseases pay little attention to borders separating one country from another. In the years to come, PAHO will continue playing a catalytic and critical role in the Americas to ensure the sustainable and equitable delivery of national immunization programs. The breakthroughs obtained in the Americas in the field of vaccine-preventable diseases throughout the 20th century, particularly in the last two decades, have given the world a definite clue of what it takes to make things happen, and what can be achieved in the 21st century.

August 1997
Volume XIX, Number 4

Western Hemisphere Leading the Way in Disease Eradication

Measles

The decision to eradicate measles is the best example of the degree of political commitment achieved in the Americas by the polio eradication campaign. Based on the successful experiences in Cuba and the countries of the English-speaking Caribbean in interrupting measles virus circulation, the Ministers of Health of the Americas adopted a resolution during the XXIV Pan American Sanitary Conference in 1994, calling for the eradication of measles transmission from the Western Hemisphere by the year 2000.

Measles transmission has already been interrupted in major geographic areas of the Region. This reduction in cases is a direct result of PAHO's recommended measles vaccination strategy, which includes a one-time catch-up vaccination campaign targeting all children 1 to 14 years of age regardless of disease or vaccination history; high coverage through routine vaccination of children 12 months of age (keep-up); and periodic complementary follow-up campaigns to reduce the accumulation of susceptible infants and children 1-4 years of age (Figure 1).

PAHO's intensified vaccination strategy is effectively protecting children in the 1-15 year age range. In the Americas, measles outbreaks now occur primarily among older children, adolescents and young adults. These persons were often born too early for routine measles vaccination, but too late to have been exposed to circulating measles virus.

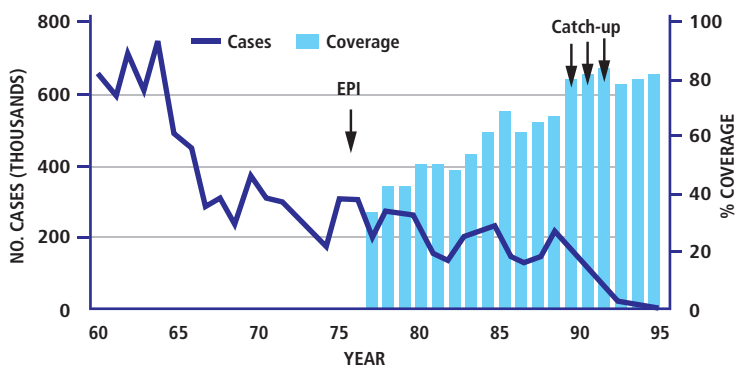
Efforts are underway to further strengthen national information systems, and to provide support for the reporting of measles surveillance data that will allow for better targeting of measles vaccination in high-risk groups. PAHO has developed a comprehensive methodology for evaluating the capacity of national surveillance systems to detect measles cases. Measures have also been taken to improve laboratory testing of suspected cases. The Regional Measles Laboratory Network supported by PAHO is collaborating with national laboratories in conducting trials that will determine the most effective measles confirmation test.

What is Needed to Eradicate Measles?

Despite the progress achieved in the Americas toward the goal of measles eradication, the virus still circulates freely in other parts of the world and the risk of importations remains. This is a particularly dangerous situation since many children and young adults remain susceptible to measles in almost every country in the Americas. The latest measles outbreaks in the states of São Paulo and Santa Catarina, Brazil and in British Columbia, Canada are a reminder of the ability of measles virus to seek out susceptible individuals in areas which have achieved and maintained high levels of population immunity. Prior to these outbreaks, São Paulo had reported very few measles cases during the previous six years, and Santa Catarina had been free of measles for three years. (*EPI Newsletter:* February, April and June 1997 issues).

The current initiative to eradicate measles will require that countries in the Americas take a pro-active approach by maintaining high levels of immunity in preschool children, and by further enhancing the capacity of the surveillance system to detect all suspected measles cases. As recommended by PAHO's measles eradication strategy, follow-up campaigns should be

FIGURE 1 Annual measles cases and vaccination coverage,* Region of the Americas, 1960–1997.**



* Vaccination coverage in childen <1 year of age.
** Date as of 26 July 1997.
Source: PAHO/SVI.

conducted when the number of susceptible preschool-aged children approaches one birth cohort. Given the changing epidemiology of measles in the Americas, increased efforts will also be needed to assure measles immunity among adolescents, young adults and people working in health care settings.

October 1997
Volume XIX, Number 5

SVI Technical Advisory Group Meets

The Twelfth Technical Advisory Group Meeting on Vaccine-Preventable Diseases (TAG) was held in Guatemala, September 8-12, 1997. The following are some of the major conclusions and recommendations.

Measles Eradication

Substantial progress has been made towards achieving the goal of measles eradication in the Americas. Transmission has been interrupted in many countries of the Region. The PAHO vaccination strategy (catch-up, keep-up and follow-up), where fully implemented, has proven to be highly effective. However, TAG pointed out that low levels of incidence can lead to a false sense of security. In the absence of measles transmission, susceptibles accumulate in a community, as a result of failure to vaccinate all children and because primary vaccination does not protect 5 to 10% of those vaccinated. These susceptibles can sustain future measles outbreaks. To maintain a measles-free state will require ongoing efforts to minimize susceptibility using the complete strategy.

The measles eradication effort is not a local or even a national campaign but a hemisphere-wide program which can only be as strong as its weakest component. This is true on a global scale as well because many cases in this Region have been linked either epidemiologically or virologically to importations from outside this hemisphere. Thus, better worldwide measles control is important to the continued success of measles eradication in the Americas.

Recommendations
General

- The occurrence of epidemic measles in a major urban area poses, by far, the most serious threat to the overall program because of the possibility of widespread disease dissemination. Accordingly, it is important that program success in all urban areas (population of >=1,000,000) be monitored on an ongoing basis by national authorities and reported to PAHO.

Vaccination Strategies

- Routine vaccination of infants (keep-up vaccination) is a critical component of the PAHO measles eradication strategy.

Children wave their certificates proving that they completed their vaccination schedule.
Source: WHO/Ministry of Health, Mexico.

- To maintain high population immunity among preschool-aged children, follow-up measles vaccination campaigns should be conducted whenever the estimated number of susceptible children 1-4 years of age approaches the number of children in one birth cohort.

Surveillance and Laboratory

- Each country should periodically evaluate the quality of its surveillance system. PAHO has developed a protocol for rapid evaluation of surveillance systems which should be disseminated to all countries of the Region. A plan should be made for these evaluations in all countries as soon as possible.
- Laboratory confirmation is an essential part of the regional measles surveillance system. A single serum specimen collected at first contact with the health care system is sufficient for confirming measles.
- Virologic surveillance is important. Clinical specimens for viral isolation should be obtained from every chain of transmission. Urine, the most practical specimen to collect, should be obtained within 7 days of rash onset and forwarded to a laboratory to be properly processed.

Outbreak Response

- Countries should not implement indiscriminate campaigns to vaccinate all adults against measles. Most adults are likely to be immune and achieving significantly higher levels of coverage among adults is extremely difficult. However, where surveillance has identified specific risk groups for measles among adults, such as university students, health care workers, or others, targeted vaccination efforts may be useful.

Management Indicators

The following indicators are essential for monitoring the performance of the program:

Notification:

- ≥80% of reporting sites report on a weekly basis the presence or absence of suspected measles cases.
- ≥80% of reporting sites report at least one suspected measles case per year.

Investigation:

- ≥80% of suspected measles cases are investigated within 48 hours of report.
- ≥80% of suspected measles cases have a blood specimen collected if there is not an epidemiological link to a laboratory confirmed measles case.
- ≥80% of measles chains of transmission have an identified source of infection.

Laboratory:

- ≥80% of specimens with results within 7 days of receipt in laboratory.

October 1997
Volume XIX, Number 5

Third Global Roundtable on Measles Control and Elimination

The Third Meeting on Advances in Measles Control and Elimination was held in August 27-29, in Atlanta, Georgia. This consultative meeting is co-sponsored by PAHO, the Centers for Disease Control and the World Health Organization.

The progress made in the global fight against measles and interruption of transmission has been demonstrated in several countries, reinforcing the view that measles eradication is technically feasible using existing vaccines and intervention strategies. This has generated a positive trend in measles control and elimination (Figure 1).

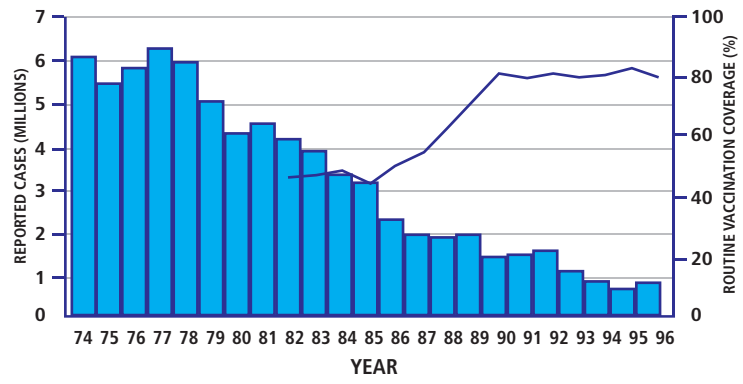
The countries of the Americas are well underway in their efforts to eliminate the disease by the year 2000 and the Pacific Island nations are expected to make a similar commitment in the near future. The European Advisory Group has recommended an elimination target date of 2007 and it is anticipated that the Regional Committee will consider this goal at its 1998 meeting. The Regional Committee of the Eastern Mediterranean will consider an elimination target of 2010. China and several southern African countries have embarked on accelerated measles control/elimination approaches.

A decision to eradicate measles worldwide will have a tremendous impact on infant morbidity and mortality. Despite the availability of an effective vaccine, measles continues to cause 42 million cases, and nearly 1 million deaths per year worldwide. Global coverage with measles vaccine is estimated at 79%. Most measles deaths occur among children under five years of age living in developing countries, particularly in Africa. This is because many children remain unprotected, particularly in poor urban areas where the case fatality is highest. The disease thrives in cities, in poor urban areas where crowding, poor sanitation and low measles vaccination coverage ensure ongoing circulation of the virus. Participants at the Atlanta meeting agreed it would be important to support urban immunization strategies to control measles in low income countries with high population density, with special emphasis on populations that have not yet been reached.

The successful completion of the global polio initiative will facilitate further progress towards measles elimination. There was consensus that polio eradication and measles elimination activities can be mutually reinforcing and represent a natural joining of efforts. However, participants highlighted that while the global efforts to eradicate polio are progressing well, much remains to be done, particularly in the Indian sub-continent and Africa. Therefore, while it is important to start planning for regional elimination of measles and ultimate eradication before the polio goal is completed, new measles activities should not jeopardize progress toward polio eradication. It will be important to initiate programs to interrupt transmission early in some of the most difficult countries in Africa, to determine the most effective strategies in these settings and demonstrate what can be done.

Sustaining interruption of measles transmission is difficult and expensive. As increasing areas of the world achieve elimination, participants agreed that the goal of global measles eradication be set and achieved in a short period of time. This will require close and effective partnerships between official agencies, private and voluntary sectors, and external donors as it was done in the Americas during the polio eradication years. A major hurdle to further improve control in areas that have obtained the greatest case reductions,

FIGURE 1 Global annual reported vaccine coverage and measles cases, 1974–1996.



Source: WHO/EPI Information System.

such as the Americas and the United Kingdom, is the ongoing circulation of measles virus in other parts of the world. While the reported incidence rate in the Americas was only 0.7 cases per 100,000 population in 1995, the reported rates in other regions were much higher. The rate in Africa was 83 times greater than the rate in the Americas, and the rate in Europe and the Western Pacific region were 13 to 10 times greater, respectively.

For sustainable impact, there was consensus that it would be important to continue strengthening the primary health care system and EPI in developing countries to achieve and maintain acceptable levels of measles control. Measles elimination is already underway in many areas but global eradication will most likely pose a number of additional challenges. Elimination activities must be integrated within primary health care to ensure the maintenance of progress and to pave the way for future elimination/ eradication initiatives.

Next Steps

Programmatic and financial obstacles must be overcome if eradication is to be achieved and strategies will need to be adjusted based on accumulating experience. Competing priorities may create difficulties in raising political commitment to measles control/elimination/ eradication. Many of the poorest countries will require significant external support. The amount of additional backing needed should be estimated soon to enable appropriate planning.

Key to rally political support for global measles eradication will be the availability of estimates of the overall cost of a global campaign. It will also be important to consider the marginal and opportunity costs of undertaking elimination or eradication. So far, different approaches have been taken to assess the economic costs, benefits and effectiveness of measles control/elimination/ and eradication efforts. They all show that measles control is highly cost-effective and that improvements in control are also highly cost-effective and may be cost-saving in some countries. Greater agreement on appropriate approaches to economic analysis would be useful, particularly with respect to eradication.

Measles eradication can convey two lasting benefits. The first, absence of measles disease (and the need for measles immunization), is obvious and indisputable. The second, permanent contribution to the development of health services, is a potential benefit which requires specific attention to maximize the benefits that can accrue to the overall health system from eradication efforts. Specific benchmarks should be developed to monitor interaction of eradication efforts and primary health care development.

Once countries progress from control to elimination goals, surveillance strategies need to be further developed and implemented to allow assessment at the most peripheral level. Based on the experience in the Americas, participants representing developed and developing countries stressed the need to implement the recommended vaccination strategies for measles eradication in full throughout a country or region. PAHO's vaccination strategy for measles eradication, which has been adopted in most countries in the Region, consists of a one-time mass vaccination campaign of all children 1-14 years of age, high coverage through routine vaccination of 1 year olds, and periodic follow-up vaccination to reduce the accumulation of susceptible infants and children 1-4 years of age.

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Measles Update

As of week 40 (October 4, 1997), a total of 48,118 suspected measles cases have been reported to the Brazilian Ministry of Health. Of these, 39,929 were reported in the State of São Paulo, which with a population of approximately 34 million is the most densely populated state of the country. So far 12,343 cases have been confirmed, most of them by laboratory testing, with a positive finding of IgM in blood samples.

Only two states (Acre and Roraima) have not reported confirmed cases of measles. The incidence rate by 100,000 inhabitants is the highest in São Paulo (28.2), second and third are Brasilia, the Federal Capital, and the state of Ceará (see Figue 1). Several municipalities with borders with Paraguay, Uruguay, Argentina and Bolivia have confirmed circulation of measles virus and include P. Velho in the state of Rondonia (2 cases), three municipalities in the state of Santa Catarina (20 cases) and one municipality in the state of Rio Grande do Sul (1 case). The most notable international transmission can be observed between the border cities of Foz de Iguaçu in Brazil and Ciudad del Este, Paraguay, with more than 90 cases. This area attracts many tourists because of the Iguaçu waterfalls and there is also high commercial activity here between the two countries.

In the current outbreak, infants and persons between 20 and 29 years of age have been the most vulnerable. Their respective attack rates were 45.3 and 19.1 per 100,000 persons. The attack rate among the group of 1 to 4 years of age was 5.5 per 100,000 persons. The highest number of patients (5,451) are between the ages of 20 and 29 years of age. The above mentioned age group consists of those who were born too early for routine vaccination, but too late to have been exposed to circulating measles virus. The groups between 1 and 20 years old who have benefited from vaccination present the lowest attack rates in this outbreak.

In the state of São Paulo a campaign aimed at children under the age of 5 was organized in August, reaching 100% of children in that age group, regardless of previous vaccination status. A preliminary analysis has shown that the number of confirmed cases from São Paulo has dropped from approximately 700 cases per day in August before the campaign, to approximately 50 cases per day in September. At the national level, a campaign was held on October 25, during which most children under 5 years of age were vaccinated against poliomyelitis and measles.

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First Ladies United Against Measles

The First Ladies of the Americas and designated representatives held their Seventh Conference of Wives of Heads of States and Government of the Americas in Panama on October 8-9, 1997, under the motto "Let us Build the Future of the Americas with Human Rights and a Culture of Peace," to evaluate achievements attained and renew their commitment to address the Region's pressing social problems.

"We reiterate our willingness to be mobilizers, facilitators or convenors for social policies and programs serving our countries, focusing on vulnerable groups, in accordance with our respective national interests and inspired by dialogue, negotiation and mutual respect," the First Ladies stated in their final communiqué, the Panama Declaration.

The First Ladies of the Americas have already been working on behalf of measles eradication since 1995, when they presented a Plan of Action during their Fifth Meeting in Bolivia, that complements the activities undertaken by each country. In the Panama Declaration, the First Ladies re-stated their support to the Regional measles eradication goal by the year 2000.

"We value the work done in countries of the Region which support the elimination of measles and other preventable diseases in the Americas. We also reiterate our commitment to continue our assistance toward this effort until measles is eradicated," the final text says.

The First Ladies recognized the valuable participation and contribution of international organizations and financial institutions stating that they have "supported our endeavors and are making possible the execution of projects and programs that serve the most needy and vulnerable sectors of our societies."

The support of the First Ladies will be critical to provide greater dissemination of the measles eradication initiative at the national and international level.

Major obstacles for the achievement of this goal are:

- Insufficient dissemination and promotion of the Plan of Action for Measles Eradication at the national/ municipal level.
- Insufficient resources to achieve the measles eradication goal.
- Routine vaccination coverage <90%.
- Inadequate logistical support for investigating all suspected measles cases.
- Limited participation of the private sector and non-governmental organizations in reporting suspected measles cases.

December 1997
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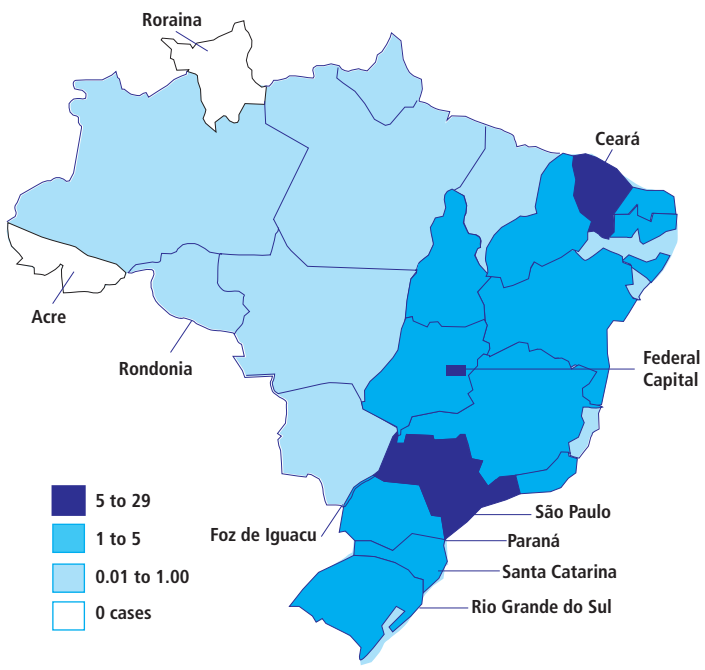
Measles in the Americas, 1997

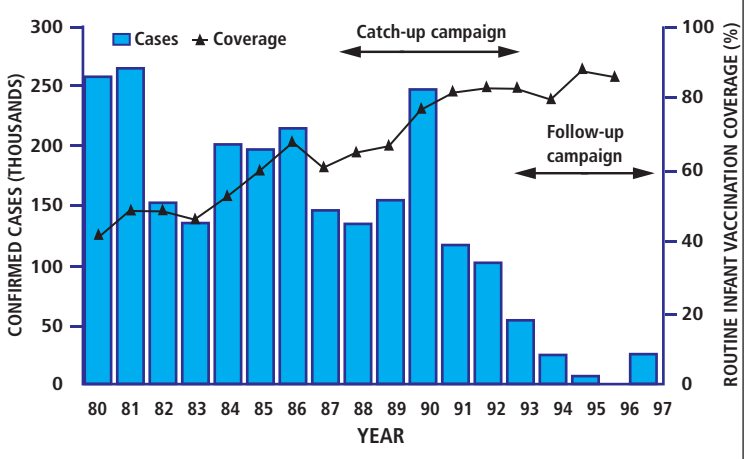
Following an all-time record Regional low in the Americas of 2,109 confirmed measles cases in 1996, there has been a resurgence of the disease in 1997 in Brazil (Figure 1). Through 29 November 1997, a total of 75,236 suspected measles cases were reported from the countries of the Americas. Of these, 26,950 (35.8%) have been confirmed, 24,527 (32.6%) have been discarded, and 23,080 (30.6%) remain under investigation. Of the total confirmed cases, 26,508 (98.3%) have laboratory confirmation of measles infection or epidemiological linkage to a laboratory confirmed case, and 442 (1.6%) have been confirmed on clinical grounds alone. Together, Brazil (25,900 confirmed cases) and Canada (577 confirmed cases) accounted for 98.2% of the total confirmed cases in the Region. However it should be pointed out that Canada

FIGURE 1 Incidence rate of confirmed measles cases by state, Brazil, 1997.



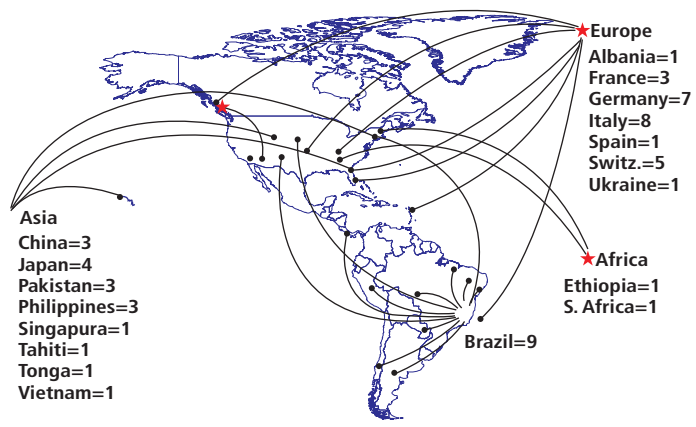
Incidence rate per 100,000 population.
Data as of week 40, 1997.
Source: GT-Sarampo/CNDI/CENEPI/FNS/MS.

FIGURE 1 Reported measles cases in the Americas, 1980-1997.*§



* Coverage for children at one year of age.
§ Cases reported through 29 November 1997.
Source: PAHO/WHO.

FIGURE 2 Measles importations into the Region of the Americas, 1997.*



* Data as of 29 November 1997.
Source: SVI/PAHO and CDC.

has had no cases for the last 18 weeks. Other countries reporting measles cases include: Guadeloupe (128 cases), the United States (127 cases), Paraguay (124 cases), Argentina (58 cases), Chile (47 cases), and Costa Rica (14 cases).

The majority of cases from Brazil have been reported from São Paulo State, the only state in the country which did not conduct a follow-up vaccination campaign in 1995. To date, over 20,000 cases have been confirmed in this outbreak, with most cases in the city of São Paulo. Over 50% of cases have occurred in young adults 20-29 years of age. The highest age-specific incidence rates are in infants, young adults 20 to 29 years of age and children 1-4 years of age, respectively. To date, over twenty-five measles-related deaths have been reported, most in infants less than 1 year of age.

An investigation of measles cases in adults found that the majority were occurring among young adults who were members of certain risk-groups including: men who recently migrated to cities from rural areas in the Northeast of the country to work in construction projects and other manual labor, students, health care workers, persons working in the tourist industry, and military recruits.

Measles virus has been isolated from several patients from this outbreak at the measles laboratory of the Adolfo Lutz Institute in São Paulo. Genomic sequencing of these isolates conducted at the Centers for Disease Control and Prevention (CDC) Atlanta, USA, revealed that the virus circulating in São Paulo is virtually identical to virus currently circulating in Western Europe. Although an index imported measles case has not been identified, the molecular epidemiology data strongly suggest that the virus responsible for the São Paulo outbreak was imported from Europe.

The São Paulo outbreak is waning after implementation of an aggressive outbreak response, which included a follow-up campaign targeting all children 1-4 years old, selective mop-up vaccination in schools and vaccination of young-adult members of groups at high-risk for measles.

Measles virus has spread from São Paulo to nearly every other state in Brazil. States most affected include: Rio de Janeiro, Ceara, Minas Gerais, Bahia, Parana, Rio Grande do Sul, Mato Grosso do Sul and the Federal District (Brasilia). Moreover, spread has been reported from several other countries in the Region, including Paraguay, Chile, Argentina, Peru, Costa Rica, and the United States.

A total of 577 confirmed measles cases were reported from Canada. A large outbreak with over 300 cases occurred primarily among young adults affiliated with Simon Fraser University, near Vancouver. This outbreak came somewhat as a surprise since the Province of British Colombia had just completed its school catch-up campaign in 1996. Genomic analysis of measles virus obtained from this outbreak performed at the Laboratory Centres for Disease Control suggests that measles virus was imported from Europe.

Measles virus from the British Colombia outbreak spread to school-aged children in Alberta, where 245 cases were reported. Other sporadic cases or small clusters have occurred in various Canadian provinces, mostly among adults due to importations. Since 1996, a total of 17 imported measles cases were documented in Canada, mostly from Europe and Asia. Since the end of July 1997, however, not a single measles case has been detected and transmission appears to have been interrupted in Canada.

To date, 127 confirmed measles cases have been reported during 1997 in the United States. This is the lowest number of cases ever reported in the United States, and is well below half the previous record low incidence of 309 cases in 1995. Almost half of the cases are documented importations. Spread from importations has been limited and the largest outbreak this year is only 8 cases. In 1995 and 1996, there were no measles importations from Latin America or the Caribbean. In 1997, however, there were 5 confirmed imported cases from Brazil.

Between October 1996 and May 1997, a large measles outbreak occurred in the French department of Guadeloupe. This island had not implemented PAHO's recommended measles eradication strategy. A total of 128 confirmed measles cases were reported. The majority of cases occurred in unvaccinated persons 12 to 18 years of age. The source of the outbreak is thought to be an unvaccinated

Editorial Note:

While the resurgence of measles in the Americas during 1997 represents a major increase compared to cases reported in 1996, these cases represent only about 10% of cases reported in 1990. Nevertheless, important lessons can be learned from this experience which can be used to "fine-tune" the Region's measles eradication strategy and to assure its full implementation in all countries. The outbreak in Brazil can be considered a wake-up call to the countries of this Hemisphere to demonstrate that the absence of measles virus circulation does not mean absence of risk from measles infection.

Several factors combined to create conditions which facilitated widespread measles transmission in São Paulo. First, the lack of a timely follow-up vaccination campaign in 1995 for children aged 1 to 4, combined with low routine vaccination coverage (keep-up) among infants using a two- dose schedule allowed for a rapid and dangerous accumulation of susceptible children. Second, the presence of large numbers of young adults who, for a variety of reasons, escaped both natural measles infection and measles vaccination increased the risk of a measles outbreak. Third, measles virus was imported into São Paulo, probably from Europe. Finally, the high population density of the city facilitated contact between persons infected with measles and susceptible persons.

Measles case surveillance data, combined with molecular epidemiologic information provided by PAHO's measles laboratory network, suggest that the countries of the Americas are constantly being challenged by imported measles virus from other regions of the world where measles remains endemic. During 1997, 23 separate importations of measles virus were detected from Europe, 17 from Asia and 2 from Africa (Figure 2) that resulted in measles transmission. These data, however, probably severely underestimate the true number of measles importations since many imported cases may not seek medical care and do not result in further transmission.

In addition to the challenge of imported measles virus, the outbreaks in Brazil, Canada and other countries of the Region suggest that there may be a significant number of young adults who remain susceptible to the disease. While PAHO's recommended vaccination strategy for measles eradication primarily targets infants and children, a small percentage of adolescents and young adults may have escaped both natural measles infection and measles vaccination. Furthermore, some young adults may have been vaccinated, but failed to respond immunologically. These young adults remain susceptible to measles.

For practical purposes, persons born before 1960 in most countries of the Americas can be assumed to have been exposed to naturally circulating measles virus, and thus be immune to the disease. Therefore, the overwhelming majority of adults are already immune, and most susceptible young adults are at very low risk for being exposed to measles virus. Mass campaigns among young adults are not recommended.

Experience has shown that certain institutional settings such as colleges and universities, military barracks, health care facilities, large factories and prisons can facilitate measles transmission, if measles virus is introduced to such populations. The close contact among persons in these settings increases the risk that a susceptible person can be exposed to measles. In fact, numerous measles outbreaks among adolescents and young adults have been documented in these settings, even in institutions with high measles vaccination coverage. In addition to persons living or working in these settings, adolescents and young adults who travel to countries with endemic measles transmission are at increased risk for being exposed to and contracting measles.

Moreover, in recent years many countries have experienced the migration of young adults from rural areas to urban areas for economic reasons. Because measles circulates more freely in cities with high population densities, persons who have recently migrated from rural areas with low population densities (and therefore lower risk for having been exposed to circulating measles virus), may be at relatively increased risk of measles susceptibility. When these persons congregate in institutional settings which can facilitate virus transmission, they have greater risk for acquiring measles, should the virus be introduced.

To prevent the occurrence of measles outbreaks among adolescents and young adults, efforts are needed to assure measles immunity in groups potentially at high-risk for measles, including college and university students and professors, health care workers, military personnel, young adults working in large factories, young adults residing in institutions such as prisons and long-term care facilities, and persons traveling to measles endemic countries.

Vaccination of adolescents and young adults entering such facilities should be routine and ongoing and should take place before persons begin working or living in these high risk settings. Moreover, catch-up vaccination activities may be considered for adolescents and young adults already in such settings. Young adults who are planning to travel to parts of the world where measles virus continues to circulate should be advised to be vaccinated before departing. These measures will enhance immunity levels in such population groups and help prevent measles outbreaks in these settings, should the virus be introduced.

The measles experience of 1997, clearly demonstrates that there are two major challenges to the Region's measles eradication goal by the year 2000. First, the countries of the Americas need to keep up their guard by maintaining the highest population immunity possible in infants and children, and targeting vaccination to adolescents and young adults who are at highest risk for being exposed to measles virus. Second, increased efforts are needed in other regions of the world to improve measles control and to decrease the number of exported measles cases to the Americas. As long as measles virus circulates anywhere in the world, the Americas will remain at risk for measles. The successful completion of the measles eradication goal will require full implementation of PAHO's recommended vaccination strategy in all countries of the Region and improved measles control/ elimination in other regions of the world, especially Europe and Asia. As mentioned previously, the only way for the Americas to assure regional measles eradication will be through the ultimate global eradication of measles virus.

10 year old child visiting from metropolitan France. Moreover, genetic analyses of measles virus obtained from the outbreak revealed that the virus circulating in Guadeloupe is very similar to virus circulating in Europe. The Ministry of Health conducted a mass vaccination campaign in affected schools. Efforts were made to provide measles vaccine to all students without documentation of having received two doses of measles vaccine. Over 3,000 students were vaccinated.

Until 1997, the English-speaking Caribbean had not reported a single confirmed case of measles in over 5 years. However, in 1997 two laboratory-confirmed measles cases were detected. The first confirmed case was reported from the Bahamas. The patient, a young adult, had rash onset in March. The direct source of transmission was not identified, however, it is strongly suspected that the patient contracted measles from a tourist. A search has been made in the country to identify any additional cases of measles. This search involved a review of over 80,000 diagnoses from health facilities in the country. The second case was reported from Trinidad and Tobago. It occurred in a young adult Italian sailor who had rash onset in April. The patient had acquired measles in Italy. A specimen was collected and found to be positive for measles IgM at the measles laboratory of the Caribbean Epidemiology Centre (CAREC). No spread cases were identified despite careful investigation.

Measles Eradication

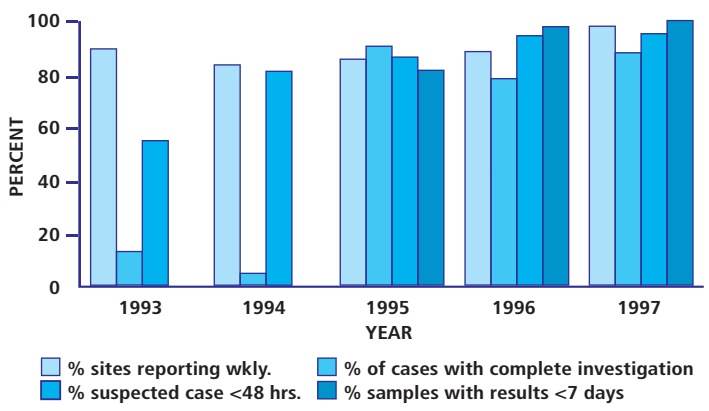
The English-speaking Caribbean still holds the longest record in the Western Hemisphere of six years without indigenous measles transmission. Two recent importations into the Bahamas and Trinidad and Tobago stressed the danger of importations and the need for adherence to PAHO's measles eradication strategy, particularly the maintenance of high levels of immunization coverage and periodic implementation of follow-up campaigns. A large outbreak in Guadeloupe in late 1996, illustrates the vulnerability of the countries to measles transmission if the strategy is not fully implemented.

The measles laboratory at the Caribbean Epidemiology Center (CAREC) provides confirmation for suspected measles cases (Figure 1). The laboratory is able to test for IgM antibodies for measles, rubella, and dengue infections. Through week 44 of 1997, a total of 847 specimens had been submitted for laboratory confirmation. Of these, 2 (0.2%) were positive for measles, 276 (31.5%) were positive for rubella and 11 (1.3%) were positive for dengue. All specimens were tested and reported back to countries within seven days of receipt.

Recommendations

- MR or MMR are the vaccines of choice for measles and rubella elimination.
- Countries that are instituting a two-dose schedule should be aware that even with such a regimen, susceptibles will accumulate because coverage with two doses will never achieve 100% and some children will remain unvaccinated. Follow-up campaigns are required to maintain interruption of transmission.
- To maintain the English-speaking Caribbean and Suriname free of measles, high vaccination coverage must be maintained. Efforts need to be made to ensure that at least 95% of each birth cohort is vaccinated with measles-containing vaccine at 12 months of age.
- The possibility of combining measles and rubella surveillance should be explored.
- To prevent the accumulation of susceptible preschool-aged children from reaching dangerous levels, follow-up campaigns should be conducted among children 1-4 years every 4 years. Countries should plan on conducting follow-up campaigns in the year 2000.
- The Brazil experience suggests that certain young adults may be at risk for measles. Efforts are needed to assure measles vaccination in young adults in high-risk groups, which include students, migrant workers, health care workers and the military.
- As long as measles circulates anywhere in the world, the English-speaking Caribbean will be at risk for measles importations. Measles surveillance systems need to detect these importations in a timely manner and respond accordingly when they occur.

FIGURE 1 Measles surveillance indicators in the English-speaking Caribbean and Suriname, 1993–1997.*



Data as of October 1997, (Epidemiological week 43).
Source: MOH Reports to EPI/CAREC.

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Caribbean Meeting Stresses Surveillance

The following are some of the major conclusions and recommendations of the Fourteenth Meeting of the Caribbean EPI Managers held in Castries, Saint Lucia, from 18- 20 November 1997.

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Importation of Measles to Costa Rica

From July through October of 1997, Costa Rica experienced a measles outbreak with a total of 12 laboratory confirmed measles cases. Ten clinically-confirmed measles cases were reported for the entire year. The following article summarizes the findings of the team that investigated the outbreak.

The measles elimination initiative was launched in Costa Rica in 1993, but only 75% vaccination coverage was achieved in children under 15 years of age during the attack phase (catch-up campaign). Since 1995, selective vaccination campaigns have been held annually, most recently in April 1997. The age for vaccination with measles-mumps-rubella (MMR) vaccine was 12 months of age prior to 1991, 18 months of age from 1991-1994, and 15 months of age from 1994 onward. In 1992, a booster dose was implemented at the age of 7 years (first grade of school). The last measles epidemic occurred from 1990 to 1992, producing more than 8,000 cases and 56 deaths. The last confirmed case of measles corresponds to that time.

From January through June 1997, there had been 49 suspected measles cases reported. Of these, 38 were discarded, 10 were under investigation and one case was clinically confirmed.

Investigation

The first laboratory-confirmed measles case (index case) was a 27 year-old from the county of Liberia in the Northwest province of Guanacaste, who worked as a cook at a restaurant on the El Tamarindo beach, a tourist complex located approximately 60 km from Liberia with at least 60 hotels. The case had rash onset on 22 July 1997, accompanied by conjunctivitis and poor general condition. On 25 July, the patient developed a generalized maculopapular rash, and was admitted to Liberia Hospital for three days. A specimen from the patient tested positive for measles at the national laboratory (INCIENSA). The result was confirmed by the Measles Reference Laboratory of the Gorgas Center in Panama.

Twenty days prior to the illness, the patient had moved from Liberia to El Tamarindo beach to work in a restaurant. The patient was living in Santa Rosa, approximately 10 km from El Tamarindo, with a population of approximately 1,000. As cook, he did not have much contact with the restaurant's clients. Community investigation did not show any suspected measles cases in Santa Rosa. The patient does not remember being vaccinated against measles.

The second documented case, a woman 33 years of age, had rash onset on 11 August, and was hospitalized for five days. On 21 August, a third case was reported in a 12 month old child from Cuajiniquil in La Cruz county, who was hospitalized that same day in Liberia Hospital. The mother revealed that her child had been previously hospitalized on 8- 9 August, with asthmatic bronchitis. There were two additional cases in Cuajiniquil, in children 13 and 14 months of age, who had direct contact with this patient.

On 9 September, two more cases were reported in Liberia. One, a girl of 7 months, was hospitalized from 21 to 25 August, with viral meningitis in Liberia Hospital. Fever and rash began ten days after her discharge, on 2 September. The other case was a girl 6 months of age, for whom there was no determined source of infection. All cases in this series were confirmed by INCIENSA and the Gorgas Laboratory.

A detailed investigation took place from 4-8 October, 1997. An analysis of vaccination coverage showed that at least 3 of the 12 counties in the province of Guanacaste did not achieve the required coverage rates for measles (more than 90%) in children under 1 year of age in the last two years.

The epidemiological history of the index case indicates that he likely contracted the virus at El Tamarindo beach, a popular tourist attraction. Most visitors come from Europe, North America, Canada, South America, and some from Central America. The largest hotels register between 35,000 and 40,000 tourists per year.

All contacts of the index case at the restaurant were interviewed without result. Next, selected hotels were visited. The manager of one said that in early July, three Brazilian tourists were lodged, one of which presented fever upon arrival and subsequently a rash appeared. A physician diagnosed measles but did not report the case. The three

guests left the hotel around 19 August 1997. This hotel is less than 100 meters from the restaurant where the index case worked, and it is probable that the tourists went to eat in that restaurant. Two other suspected measles cases were found during the active search.

PAHO contacted the Ministry of Health in Brazil to investigate the suspected measles case from this Brazilian tourist. The case was confirmed as measles and it was also determined that the case was from the São Paulo area.

An analysis was carried out of all patients that entered the Hospital of Liberia from mid-July through the end of September, to determine whether these patients had disseminated the virus to other regions of the country upon leaving the hospital. It was found that patients from all 12 counties of the Guanacaste province had been hospitalized, as well as people from five other counties of the country, including San José, and two patients from Nicaragua.

Control Measures

Selective vaccination was carried out in the county of Liberia targeting the entire population under 15 years of age. A national vaccination campaign against measles was implemented on 20 October 1997.

All countries in the Region of the Americas were alerted, particularly those in Central America, of the high risk of importations, especially in areas with low vaccination coverage.

Conclusions

Measles virus circulated in the province of Guanacaste from July to October 1997. The first case was presented in an adult of 27 years, hospitalized on 25 July in the hospital of Liberia. Eleven more cases were confirmed, the last in October. No other cases have been confirmed either in the Guanacaste province or in the rest of the country. Almost all the cases in the first generation in the counties of Liberia and La Cruz had contact with the Liberia Hospital as source of infection and were linked to the index case. This suggests that transmission took place within Liberia Hospital.

As recommended by the XII Technical Advisory Group on Vaccine-Preventable Diseases (TAG) in Guatemala, it is necessary to monitor vaccination coverage by district and to characterize districts at high-risk for measles (coverage less than 90%). Viral isolation is required from all chains of transmission. An adequate sample of urine should be taken in sterile container at first contact (preferably within one week of rash onset) with suspected measles cases.

Source: Ministry of Health, Costa Rica.

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Measles Vaccination Campaigns

Follow-up vaccination campaigns are an essential component of PAHO's measles eradication strategy. A follow-up campaign is defined as a periodic measles vaccination campaign which targets all children 1 to 4 years of age, regardless of prior vaccination status or disease history.

However efficient the catch-up (vaccination campaign aimed at all children 1-14 years of age) and keep-up (vaccination through routine services) vaccination efforts are, there will inevitably be an accumulation of measles susceptible preschool-aged children over time. The primary purpose of follow-up campaigns is to prevent this accumulation of susceptible children from reaching dangerous levels which can increase the risk of a measles outbreak.

Two factors contribute to the build-up of susceptible children. First, the measles vaccine is less than 100% effective, thus leaving some children unprotected following vaccination. Second, measles vaccination coverage for each birth cohort will almost always fall short of reaching all children.

PAHO's measles eradication strategy recommends that periodic follow-up vaccination campaigns be conducted whenever the estimated number of measles susceptible preschool-aged children (children 1-4 years of age) approaches the size of an average birth-cohort. The interval between campaigns will depend upon the vaccination coverage obtained among infants through routine services since the last campaign. The lower the average routine vaccination coverage, the shorter the interval between campaigns. For example, if an average of only 60% routine coverage is obtained, a follow-up vaccination campaign would be needed approximately every two years; if 80% average coverage is obtained, then campaigns will be needed approximately every four years. The maximum allowable interval between campaigns is 4 years. Most countries of the Americas are able to maintain an average routine coverage of at least 80% and conduct follow-up campaigns every 4 years.

Table 1 summarizes available data concerning measles vaccination activities by country. At this point, there are several countries which are overdue for follow-up campaigns or are due for campaigns in 1998. The following countries overdue for a campaign are at relatively increased risk for measles outbreaks and should conduct follow-up campaigns as soon as possible: Argentina, Costa Rica, Cuba, Dominican Republic, Haiti, and Mexico. The following countries are due to conduct follow-up campaigns in 1998: Bolivia, Ecuador, Venezuela and Uruguay.

TABLE 1. Measles vaccination campaigns.

Region	Country/ Territory	Campaign 1–14 (Catch-up) Year	Campaign 1–14 (Catch-up) Coverage (%)	Average routine coverage 1994–1996 (Keep-up)	Campaign 1–14 (Follow-up) Year	Campaign 1–14 (Follow-up) Coverage (%)	Next Follow-up due
Andean	Bolivia	1994	98	90			1998
	Colombia	1993	96	93	1995	90	1999
	Ecuador	1994	99	70	...	...	1998
	Peru	1992	75	87	1995	97	1999
	Venezuela	1994	99	75	...	...	1998
Brazil	Brazil	1992	96	80	1995	77	1999
Central America	Belize	1993	82	82	1995	85	1999
	Costa Rica	1993	75	90	–	–	1998*
	El Salvador	1993	96	89	1996	82	2000
	Guatemala	1993	85	73	1996	60	1998
	Honduras	1993	96	91	1996	85	2000
	Nicaragua	1993	94	81	1996	97	2000
	Panama	1993	88	86	1996	94	2000
English-speaking Caribbean and Suriname	Anguilla	1991	99	97	1996	99	2000
	Antigua and Barbuda	1991	96	95	1996	92	2000
	Bahamas	1991	87	91	1997	78	2001
	Barbados	1991	96	98	1996	91	2000
	Dominica	1991	88	99	1996	90	2000
	Grenada	1991	85	92	–	–	–
	Guyana	1991	95	95	1996	99	2000
	Cayman Is.	1991	98	89	1996	81	2000
	British Virgin Islands	1991	94	84	1996	90	2000
	Jamaica	1991	71	87	1995/6	85	1999
	Montserrat	1991	99	99	1996	99	2000
	St. Kitts and Nevis	1991	98	99	1996	99	2000
	St. Lucia	1991	97	94	1996	85	2000
	St. Vicente and Granadines	1991	97	99	1995	84	1999
	Suriname	1991	89	75	1997	...	...
	Trinidad and Tobago	1991	90	88	1997	96	2001
	Turks and Caicos	1991	81	98	1996	95	2000
Latin Caribbean	Cuba	1987	98	99	1993	99	1998*
	Dominican Republic	1993	77	84	...	...	1998*
	Haiti	1994	94	28	...	...	1998*
Mexico	Mexico	1993	88	91	...	...	1998*
Southern Cone	Argentina	1993	97	98	...	...	1998*
	Chile	1992	99	94	1996	99	2000
	Paraguay	1995	70	78	...	...	1999
	Uruguay	1994	95	88	...	...	1998

... Data not available.
– No campaign.
* Overdue.
Data as of 21 January, 1998.

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Update: São Paulo Measles Outbreak

This article updates the information published in the June 1997 edition of the *EPI Newsletter.*

During 1997 and through 20 January 1998, a provisional total of 26,722 confirmed measles cases was reported from the countries of the Americas. Of these, 25,599 (96%) were reported from Brazil. Of the Brazil cases, 20,459 (80%) occurred in the state of São Paulo. The outbreak began during late 1996 with a total of 27 confirmed cases. During 1997, cases were reported from over 250 of the state's 645 municipalities. Of the total cases, 18,542 (91%) were reported from the Greater São Paulo metropolitan area.

The age-groups most affected by the São Paulo outbreak were infants under 1 year of age, (440 cases/100,000 population), followed by young adults 20-29 years, (164 cases/100,000), children 1-4 years (47 cases/100,000) and children 5-9 years (32 cases/100,000).

As of 20 January, a total of 20 measles deaths were reported (1 death per 1,022 reported cases, total case-fatality rate of 0.10%); 17 (85%) were residents of the Greater São Paulo metropolitan area.

The age distribution of persons dying of measles is as follows: 11 (55%) were infants less than one year of age, 3 (15%) were children 1-4 years of age, 2 (10%) were children 5-9 years of age, and 4 (20%) were young adults 20-29 years of age. The following age-specific case-fatality rates were observed: in infants <1 year of age (0.38%), children 1-4 years of age (0.25%), children 5-9 years of age (0.20%) and young adults 20-29 years of age (0.04%).

The following strategies were implemented with the goal of reducing measles virus circulation:

- Lowering the age of routine measles vaccination from 9 months to 6 months.
- Selective vaccination of unvaccinated children under 5 years of age in June 1997 (161,987 doses administered).
- Vaccination of health workers (182,562 doses administered).
- Extended contact vaccination of persons under 30 years of age, to reach those possibly exposed to cases of measles, including households, neighborhoods, workplace, schools and other high-risk groups (856,534 doses

Editorial Note:
Although outbreak investigation is continuing, the São Paulo experience clearly demonstrates both the infectiousness and lethality of measles virus. Following a prolonged period of low measles incidence, the virus returned with a vengeance in São Paulo State. Measles has demonstrated its ability to find susceptible persons, even in areas with high vaccination coverage.

Several factors appear to have combined to create conditions that facilitated measles transmission in São Paulo. First, the failure to conduct a follow-up vaccination campaign in 1995, combined with low routine vaccination coverage (keep-up vaccination) among infants, allowed for the accumulation of susceptible children in São Paulo. Second, the presence of large numbers of susceptible young adults who, for a variety of reasons, escaped both natural measles infection and measles vaccination increased the risk of a measles outbreak. Third, measles virus was imported into São Paulo, most probably from Europe. Finally, the high population density of the city facilitated contact between persons infected with measles and susceptible persons.

Available surveillance data suggest that the major outbreak control activities implemented in São Paulo helped to reduce the number of susceptibles and slow the epidemic. However, these control measures were very expensive in terms of financial and human resources, not to mention the opportunity cost of the interventions. Over 4.5 million persons were vaccinated in these efforts. Combined with the direct costs associated with medical care and the indirect costs due to decreased productivity, both acutely and chronically, this outbreak was very costly.

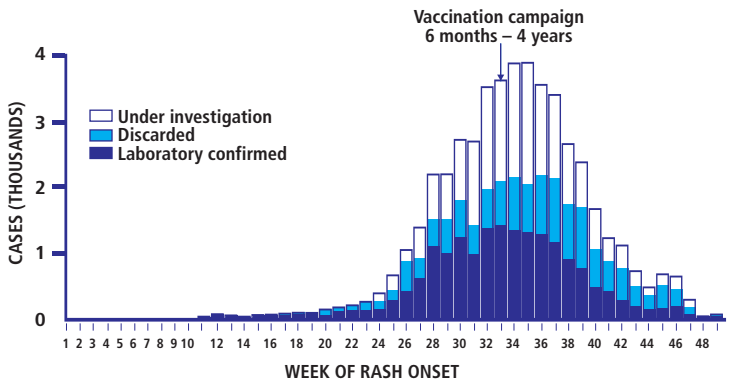
The overriding objective of PAHO's measles eradication strategy is the prevention of measles outbreaks. It is far better (and cheaper) to prevent an outbreak than to be forced to attempt to control an outbreak. Measles outbreaks can be prevented by achieving and maintaining high population immunity in susceptible populations, combined with the absence of imported measles virus.

São Paulo will now need to redouble its efforts to prevent future measles outbreaks. High coverage levels of measles vaccination must be achieved and maintained for infants at their first birthday. Follow-up campaigns must be conducted every four years to assure the highest possible level of measles population immunity. A two-dose schedule is clearly not an appropriate measles eradication strategy unless nearly universal coverage can be assured in a timely manner for both doses of measles vaccine. Moreover, efforts need to be made to assure immunity in adolescents and young adults who are at highest risk for exposure to measles virus. These interventions, combined with the reduction of measles importations from other regions of the world, will greatly decrease the risk of another major measles outbreak in São Paulo or elsewhere in the Americas.

administered).
- Indiscriminate vaccination of children 6 months through 4 years 11 months of age in August 1997 (3,085,221 doses administered). Coverage is estimated to be 100% using official population data.
- Selective vaccination of school-aged children between 5-15 years of age between September and November 1997 (298,039 doses administered).
- Intensification of routine vaccination against measles for children between the ages of 9 and 15 months of age.

These interventions appeared to have been effective in slowing the epidemic. From week 36 on (two weeks after the indiscriminate vaccination campaign) there was a sharp drop in the number of cases (Figure 1). In addition to this drop, there was a marked reduction in the proportion of suspected measles cases that were confirmed by laboratory testing. Prior to the campaign (weeks 24 to 33), 67% of suspected measles cases were confirmed by laboratory, and following the campaign (weeks 36 to 45) only 43% were confirmed.

FIGURE 1 Classification of suspected measles cases by week of rash onset, São Paulo, Brazil, 1997.*



* As of 15 January 1998.
Source: Center for Epidemiological Surveillance, São Paulo.

The Center for Epidemiological Surveillance of the São Paulo State Health Secretariat, in collaboration with the National Health Foundation of the Ministry of Health and the State Promotion for Mass Immunization and Education (FESIMA), along with PAHO are conducting a detailed study to determine the risk factors for acquiring measles in this outbreak. This study seeks to track the dynamic of measles virus transmission and other factors that may explain the occurrence of this epidemic.

Source: Center for Epidemiological Surveillance, São Paulo State Health Secretariat, Brazil.

April 1998
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Paraguay and Brazil Discuss Joint Strategies for the Eradication of Measles

On February 12-13, 1998, a technical meeting was held in Curitiba, Brazil, to establish immediate strategies for controlling measles outbreaks in the border municipalities between Paraguay and Brazil. A project was prepared for technical cooperation between countries (TCC) to eradicate measles from the municipalities along the border between the two countries. TCC projects are a key component of PAHO's technical cooperation because they foster collaboration among countries in the Region to solve a particular health problem or set of problems. Representatives from the Ministries of Health of Brazil and Paraguay and at the regional and municipal levels attended the meeting. Also present were members of the Brazilian Cooperation Agency (ABC) within the Ministry of Foreign Affairs of Brazil, the Ministry of Health of Argentina, and PAHO country staff in Paraguay and Brazil.

Background

The measles epidemic that began at the end of 1996 in Brazil and lasted through 1997, with more than 26,000 confirmed cases, affected several countries in Latin America, including Paraguay. The two countries share a large border with a heavy flow of people. Therefore, there is a mutual interest to act jointly in activities for epidemiological surveillance and immunization to reach the Regional goal of measles eradication by the year 2000.

In Brazil, the border population of Paraná State with Paraguay is estimated at 370,000, spread among 11 municipalities, of which nine have achieved vaccination coverage over 95%. Two municipalities reported confirmed measles cases in 1997: Foz do Iguaçu with 77 cases and Santa Terezinha do Itaipú with 9 cases. In the state of Mato Grosso do Sul, the border population is estimated at 183,713, also distributed among 11 municipalities. Despite the lack of laboratory-confirmed measles cases, five

clinically confirmed cases were reported. Vaccination coverage was over 95% in two municipalities.

In Paraguay, there was a resurgence of measles cases due to an importation from Brazil, with 198 laboratory confirmed cases. The highest incidence occurred in the 10th health region (Ciudad del Este) with 105 cases, and the 14th health region (Canindeyú) with 14 cases, both bordering on the states of Paraná and Mato Grosso do Sul, respectively.

The tourist and commercial traffic across the Ponte Internacional da Amizade, which connects Ciudad del Este and Foz do Iguaçu is an important risk-factor in the transmission of measles virus in the region. The total border population is 701,423, and vaccination coverage in this area fluctuates between 40 and 60%.

Argentina also experienced an outbreak in 1997, which is still ongoing. During that year, the first confirmed cases appeared in the province of Misiones, which borders on Paraguay and Brazil. Measles then spread to metropolitan Buenos Aires and the capital city. A total of 762 cases were reported of which 112 were confirmed. Seven of these were in the province of Misiones. In 1998, at the time of the meeting, 47 cases were confirmed, all in the metropolitan area. Three-quarters of the reported cases have occurred in children under 5 years of age. The Ministry of Health scheduled a measles follow-up vaccination campaign for children under 5 in May. At the same time, the Ministry is implementing routine vaccination with measles-mumps-rubella (MMR) vaccine for children ages 12 months to 6 years.

Conclusions

There have been 205 confirmed measles cases in the border area between Brazil and Paraguay, which has a population of approximately 1,500,000 inhabitants. The following problems were identified in the border municipalities of both countries:

- Limited exchange of information on the occurrence of measles cases.
- Underreporting of measles cases.
- Lack of timely control measures.
- Lack of coordination among the responsible authorities in the border areas.
- A heavy flow of persons in the border areas.
- The presence of indigenous villages in four border municipalities in Mato Grosso do Sul
- Passive and unstructured surveillance in some regions and municipalities.
- Difficulties in the interpretation of coverage data.
- Lack of coordination to develop adequate vaccination and epidemiological surveillance strategies.

On the basis of these findings, there was consensus on setting up three local border committees. These committees will be comprised initially of those in charge of surveillance in the municipal and regional health secretariats and the National Health Foundation of the border municipalities in Brazil, as well as those responsible of the health regions in Paraguay (in equal numbers between the two countries). Among its initial functions will be establishing joint flows of information on epidemiological surveillance operations, (weekly negative notification of cases and notification of suspected and confirmed cases) and planning of joint operations in support of measles eradication.

A project was developed and approved to provide technical support for the joint activities between the two countries at the local level. This project seeks to improve communication between municipal health secretariats in Paraná and health regions in Paraguay on the border of these two countries to strengthen surveillance activities and immunization programs for measles and other vaccine-preventable diseases; and to further stimulate joint solving of health problems.

Source: Meeting Report.

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Districts at Risk for Measles in El Salvador

Following the re-introduction of measles virus in Central America through an outbreak in Costa Rica in 1997, El Salvador reviewed the vaccination coverage levels of children under 1 year of age in all its 262 districts, to determine which had not reached coverage levels of at least 90%.

Background

One of the recommendations for measles from the Technical Advisory Group Meeting (TAG) held on September, 1997 in Guatemala, is to target vaccination efforts to areas at relatively higher risk for measles transmission. These include those districts with coverage for measles vaccine <90% in children under 1 year of age, especially in urban areas with high population density.

In October 1997, the Ministry of Health analyzed all 262 districts in El Salvador, to determine their relative risk for measles outbreaks. The average number of "at risk" districts during the period 1995-1997 has been approximately 70 districts per year. The number of children susceptible to measles accumulated every year in these districts has been approximately 15,000. In 54 of these districts, low coverage has been recurrent, that is <90% for at least 2 years since 1995, and in 20 of the 54 districts, low coverage has been occurring for the past 3 years. The population of children under 1 year living in those districts is between 30,000 to 35,000, or 26% of the country's official population data in this age group.

The following criteria were used to define high-risk districts:

- Average vaccination coverage obtained from all districts from January to June 1997.
- Population density in these districts.
- Number of children under 5 years of age susceptible to measles that had accumulated in the last 3 years.

Based on the country's trend of average vaccination coverage, the expected number of high-risk districts at the end of 1997 would have been 84, mostly located in rural areas. Sixty-five have low population density (fewer than 500 children under 1 year of age), representing 26% of the target population; 10 have between 500 and 1,000 children under 1 year of age; 4 have between 1,500 and 3,000 children under the age of 1 year old; and 5 districts situated in urban areas have over 3,000 children in that age range (42% of the target population).

Based on this analysis, the Ministry of Health of El Salvador organized in November and December 1997, a mop-up measles vaccination campaign in these 84 districts, aimed at children under 5 year of age, to increase population immunity and reduce the risk of measles outbreaks. House-to-house vaccination was carried out in these districts, using the current routine vaccination schedule, which is one dose of measles vaccine at 9 months and one dose of MMR at 15 months. Including first doses and boosters, a total of 36,560 doses of measles vaccine and 8,637 doses of MMR were administered to children under the age of 5 years.

Results

A total of 116 districts (32 additional districts participated in the mop-up campaign to increase population immunity) carried out house-to-house vaccination activities during this campaign. The population of children less than 1 year of age in these districts is 91,115 children, representing 57% of this population group in the country (160,023). A total of 69,552 houses were visited, of which 52,494 were found occupied. A total of 41,597 children under 5 years of age were found in these houses.

The mop-up vaccination campaign against measles carried by El Salvador in targeted districts was very effective. The campaign succeeded in achieving higher measles vaccination coverage in districts that otherwise would not have reached the recommended 90% coverage by the end of 1997. The most important achievement of this effort was the reduction from 84 to 61 in the number of districts at risk for measles.

As a result of the campaign, there was an increase in districts reaching higher than 90% coverage (201 of 262 districts). However, there still remain 61 districts at risk, four of them due to high population density (more than 3,000 children under 1 year of age.)

Recommendations

- Continue strengthening routine infant vaccination programs by assuring daily immunization services and avoiding missed opportunities to vaccinate.
- During the next National Immunization Day, target resources toward districts at higher risk.
- Continue monitoring vaccination coverage by district at least every three months, as well as their performance in meeting the epidemiological indicators for surveillance, which are critical for the eradication of measles.
- Avoid the accumulation of susceptible persons, especially in districts with high population density and high influx of foreign visitors. These factors favor the reintroduction of measles virus to the country, and constitute an impediment to the eradication of measles in the Region of the Americas.
- Strengthen epidemiological surveillance throughout the country, primarily in the "silent" districts, which are those that have never reported suspected measles cases or have low rates of weekly negative notification.

Source: Ministry of Health of El Salvador.

Editorial Note:

The Pan American Health Organization urges countries to follow the example of El Salvador by characterizing in more detail vaccination coverage obtained at the district level, and the population living in those districts that have not been vaccinated.

June 1998
Volume XX, Number 3

USA Interrupts Measles Transmission

During 1997, a provisional total of 138 confirmed measles cases was reported to the Centers for Disease Control and Prevention (CDC) by local and state health departments, the lowest number of measles cases ever reported in 1 year and a 55% decrease from the previous record low of 309 cases reported in 1995 (Figure 1). This report describes the epidemiology of measles in the United States in 1997, which suggests that no endemic measles virus is circulating.

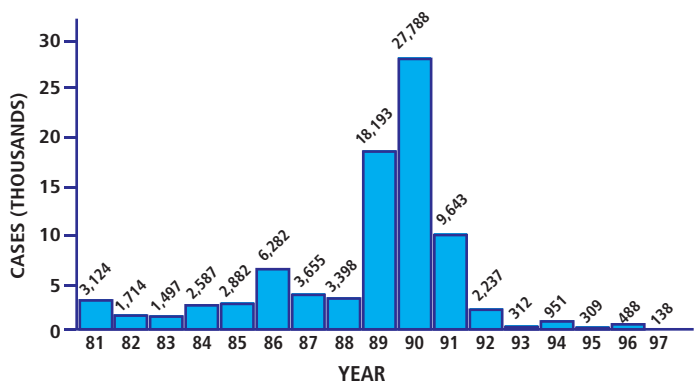
Case Classification

Reported measles cases are classified as imported or indigenous based on where transmission of measles virus is likely to have occurred. Cases in persons who traveled outside the United States within 18 days before rash onset are classified as international importations. Indigenous measles cases are classified into three groups: 1) cases linked epidemiologically to a known international importation, 2) cases in which a measles virus strain is isolated that has been associated with other countries, and 3) all other cases in which no association to an importation was detected.

Of the 138 cases reported in 1997, a total of 57 (41%) were international importations. Thirty-six (63%) occurred in visitors traveling to the United States from other countries. The remaining 21 imported cases occurred in U.S. residents who were abroad during the exposure period. The countries from which measles was most frequently imported were Germany (nine cases), Italy (nine), Switzerland (five), Brazil (five), and Japan (four).

Of the 81 indigenous cases, 17 (21%) cases were linked epidemiologically to international importations. The maximum number of cases epidemiologically linked to a single imported case was four. The longest reported chain of measles transmission following an imported case lasted 5 weeks. Measles virus was isolated from two chains of transmission that included seven (9%) of the 81 indigenous cases; the isolated measles strains have been associated with disease in other countries. There was no epidemiologic link or virologic evidence suggesting importation for the remaining 57 (70%) of the 81 indigenous cases. In 1997, there was epidemiologic or virologic evidence of an international source for 81 (59%) of the 138 cases reported to CDC, compared with 15% in 1995 and 28% in 1996.

FIGURE 1 Measles in the United States, 1981–1997.*



* As of 18 April 1998.
Source: National Immunization Program, CDC.

Geographic Distribution

In 21 states, no measles cases were reported for 1997, and in 20 states and the District of Columbia, fewer than five cases were reported. Nine states (Arizona, California, Florida, Massachusetts, Minnesota, New York, Pennsylvania, South Dakota, and Texas) accounted for 64% of total cases and 56% of imported cases.

Temporal Patterns of Transmission

The maximum number of reported cases occurring in a single week was 11, and the median number of cases per week was two. In 9 weeks, no reported cases occurred, and in 21 weeks, all reported cases were associated with imported cases.

Age and Vaccination Status

The predominant age groups with confirmed measles were preschool-aged children (1-4 years) (40 [29%] cases), followed by persons aged 5-19 years (39 [28%] cases), and persons aged 20-39 years (36 [26%] cases). Of the 138 patients, 32 (23%) had a documented history of vaccination with measles-containing vaccine (either measles, measles-rubella or measles-mumps-rubella): 25 (18%) patients had received one dose, and seven (5%) had received two doses. The remaining 106 (77%) patients reported being unvaccinated. For all persons with reported measles in age groups for which vaccine is recommended, 62% were unvaccinated.

Outbreaks

A total of 13 outbreaks, defined as three or more epidemiologically linked cases, were reported to CDC by 11 states. Outbreak-related cases accounted for 44% of all cases. The largest outbreak involved eight cases (median: 4; range: 3 to 8 cases). Adult/post-school-related and preschool-related outbreaks were the most common, with four outbreaks each, and three

Editorial Note:

The United States has made remarkable progress towards eradicating measles. The provisional total of 138 measles cases reported for 1997 is the lowest in history of the country. When compared to the 27,000 plus reported cases during the resurgence of measles in 1990, this represents a 99.5% reduction. Available data strongly suggest that measles virus transmission has been interrupted in the United States and most cases are now due to imported measles virus.

Over half of the reported cases in the United States during 1997 had epidemiologic or virologic evidence of having an international source of infection. It is noteworthy that of the 57 measles cases that acquired infection in another country, only 5 (8.8%) were from other countries in the Americas. European countries and Japan were responsible for the majority of imported cases to the United States. Combined with regional measles surveillance data, this information further confirms the progress made towards measles eradication in the Americas.

Moreover, these data demonstrate the interdependence of the countries of the Region for measles eradication. When measles virus circulates in any country of the Americas, other countries of the Region will be at increased risk for importations. On the other hand, when measles virus circulation has been interrupted in the Region, the risk of importations from neighboring countries will evidently decrease.

In addition to benefiting from fewer international importations, the United States has been successful in increasing population immunity among preschool-aged and school-aged children. In 1996, measles vaccine coverage among children 19-35 months was estimated to be 91%, compared to an estimated 80% in 1992. Moreover, approximately 70% of school-aged children have received two doses of measles vaccine. The achievement and maintenance of high population immunity in the 1-20 years age group should prevent sustained measles transmission when the virus is imported.

Similar to the countries of Latin America and the Caribbean, great progress has been made in the United States towards eradicating measles. However, the maintenance of a measles-free status over a period of many years can be difficult to sustain, especially when measles virus continues to circulate in other regions of the world. The United States and other countries of the Americas must work hard to maintain high levels of population immunity. Increased efforts are urgently needed to eradicate measles from other regions of the world. Only global eradication will assure the absence of measles importations to the Americas.

outbreaks involved persons with philosophic or religious objections to vaccination. One school-related and one college-related outbreak also were reported. Five (38%) of the 13 outbreaks had known international sources.

Reported by: State and local health depts. Measles Virus Section, Respiratory and Enteric Viruses Br, Div of Viral and Rickettsial Diseases, National Center for Infectious Diseases; Measles Elimination Activity, Child Vaccine Preventable Disease Br, Epidemiology and Surveillance Div, National Immunization Program, CDC.

Source: MMWR, 47(14); 273-276; April 17, 1998.

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Measles Outbreak in Ñuble Province, Chile

Between July and September of 1997, nineteen measles cases were reported from the province of Ñuble, a predominately rural area in southern Chile. The index case was strongly suspected to be a tourist from São Paulo, Brazil who visited a ski resort in the city of Chillan during the first two weeks of July. During his stay, he developed a fever and rash illness but apparently did not seek medical attention.

During his illness, the tourist from São Paulo came into contact with a local ski instructor. Approximately two weeks later, the ski instructor developed a febrile rash illness and was diagnosed with suspected measles at a local clinic. A blood specimen was collected and provincial and national health authorities were immediately notified. The specimen tested positive for anti-measles IgM antibodies at the National Insititute of Health laboratory in Santiago, Chile. During the months of August and September, an additional 18 laboratory-confirmed cases were reported in the province of Ñuble.

Persons with confirmed measles cases ranged in age from 3 months to 36 years. Of the 19 total confirmed measles cases, 3 (15.7%) were in infants <1 year of age, 2 (10.5%) were in persons 15-19 years of age, 10 (52.6%) were in persons 20-29 years of age, and 4 (21.0%) were in 3 persons 30-39 years of age. Nine (47.4%) cases occurred in employees of the ski resort in Chillan. None of the persons had received measles vaccine during their childhood. Three (15.7%) cases reported receiving measles vaccine during the national follow-up campaign in 1997.

Of the total cases, 10 (52.6%) persons acquired measles infection in the ski resort, 5 (26.3%) acquired measles in the neighboring community, and 4 (21.1%) acquired measles in the household from a family member.

Two patients with measles were hospitalized; both were less than 1 year of age. All patients recovered and no major complications were reported.

Outbreak control efforts focused on providing measles vaccination in a timely manner to contacts of suspected measles cases, especially infants under 1 year of age, and persons 20-40 years of age. Based on the epidemiologic data available, persons in these age-groups were felt to be at highest risk. Moreover, efforts were made to vaccinate employees at the ski resort and health care workers between 20 and 40 years of age. Finally, a community-wide vaccination campaign for persons <1 year and 20-40 years of age was carried out in the area near the ski resort.

Source: Muñoz, C.; Parra, M.; Orrego, M.; Rivera, L.; Campos, K.; Zambrano, O.; Revista Chilena de Infectología, 1997; 14(2): 110-118.

Editorial Note:
This outbreak clearly demonstrates the extreme infectiousness of measles and its ability to affect susceptible persons, even in countries which have achieved and maintained high vaccination coverage in their routine vaccination programs. The outbreak investigation strongly suggests that measles virus was introduced into the ski resort area from a visitor from São Paulo, Brazil. During 1997, São Paulo experienced a large measles outbreak, with over 57,000 suspected cases and approximately 21,000 confirmed cases.

The majority of the measles cases in Ñuble occurred in young adults outside the age-group targeted for measles vaccination in Chile. These persons were born too early to have received measles vaccines, but born too late to have been exposed to naturally circulating measles virus. Furthermore, most infected persons had been born and raised in rural areas, thus decreasing their risk of exposure to measles virus.

Measles transmission was extremely limited in this outbreak. This is a result of the high population immunity which exists in the population 1-20 years of age, due to Chile's measles eradication efforts. Moreover, the combination of careful and timely surveillance followed by an aggressive outbreak response with contact vaccination likely helped to limit the virus' spread.

Similar to the São Paulo experience (see *EPI Newsletters*, June 1997 and February 1998 issues), this outbreak clearly demonstrates that there is a certain percentage of young adults in Chile and probably most countries of the Americas who remain susceptible to measles. Efforts to provide vaccination to populations of young adults at highest risk for being exposed to measles virus are also required. Groups of young adults that should be targeted for ongoing vaccination include: healthcare workers, university students, military recruits, and international travelers to measles endemic areas.

June 1998
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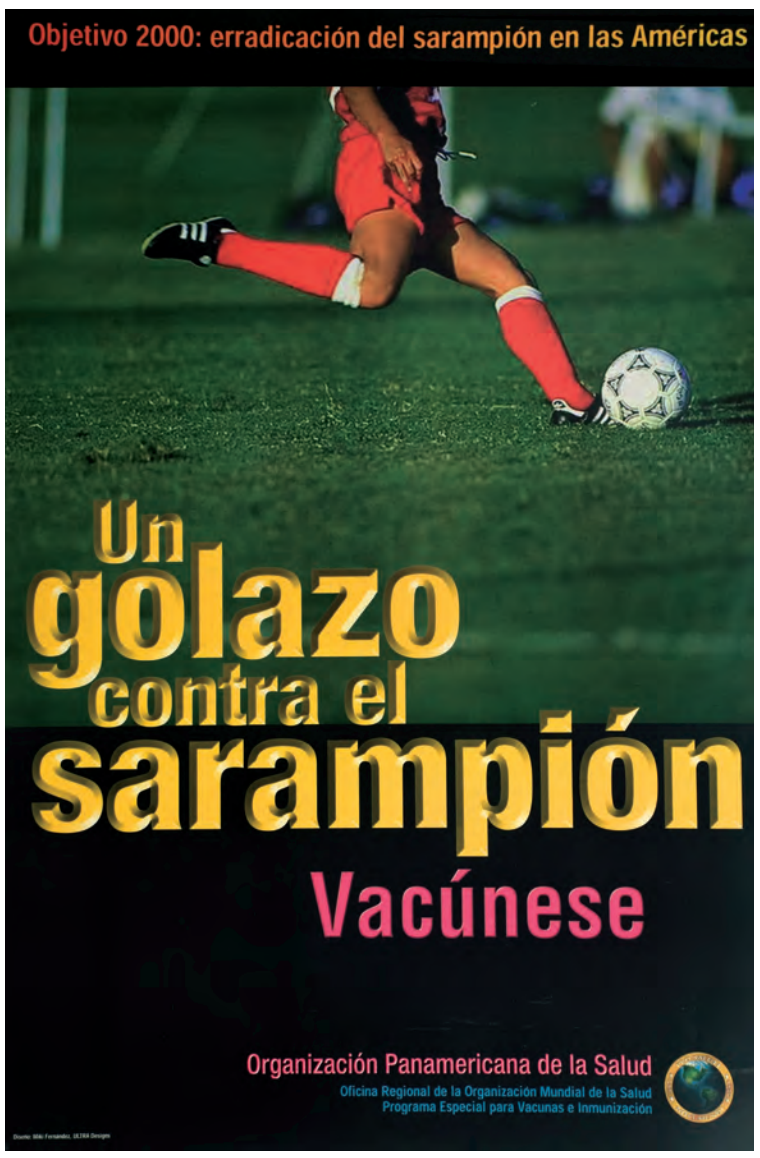
The Americas Play to Win the Fight Against Measles!

From June 10 to July 12, the 1998 World Cup Soccer Championship will be held in France. For a little over a month, soccer teams representing 32 nations will play their best games in the hope of winning the coveted gold cup. The Americas will cheer on the eight teams representing our Region: Argentina, Brazil, Chile, Colombia, Jamaica, Mexico, Paraguay, and the United States. There is no other event that grabs people's attention with the same intensity as the World Cup. Since the first World Cup in Montevideo, Uruguay in 1930, people from different nationalities have shared during the entire month the fervor of each game and witnessed the determination of players to reach their objective: winning the gold cup.



The teams from the Region of the Americas have an excellent opportunity to be among the winners of the World Cup. Likewise, all countries in the Americas can be winners by eradicating measles from the Region by the year 2000. In the spirit of this global event, we should all unite and give measles its final blow! The Americas has already shown the world how to effectively mobilize support from all sectors of society in the campaign to eradicate poliomyelitis in 1991. The same commitment is needed to overcome the obstacles, and make measles eradication a reality. Following a record low number of cases in 1996, measles resurfaced in Brazil in late 1997, affecting primarily young adults and unvaccinated populations in the state of São Paulo. This outbreak produced approximately 30,000 confirmed cases and spread to several countries in the Region.

Measles is a highly infectious disease! In order to eradicate it, countries need to:

- Assign sufficient resources to have adequate supplies of measles vaccines.
- Place high priority on measles surveillance. Mobilize the support of communities to ensure widespread notification of suspected measles cases.
- Guarantee high coverage levels of measles vaccination (above 95%) for infants at their first birthday in all areas of a country.
- Carry out follow-up measles vaccination at least every 4 years to assure the highest possible level of measles population immunity.
- Prevent outbreaks by targeting for vaccination young adults at risk of contracting the disease. Groups considered at risk include: health workers, military personnel, university students, construction workers and young adults that emigrate from rural areas to large urban centers. Vaccination of these groups should be ongoing.

August 1998
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Measles Update

Follow-up campaign in Venezuela

Venezuela conducted a national follow-up measles vaccination campaign in the country's 23 states, aimed at all children between the ages of 1-4 years (target population: 2,223,210). The campaign started on May 19

Follow-up vaccination campaigns are critical for the successful completion of the measles eradication goal.

and lasted through the middle of June. Vaccination using measles-mumps-rubella (MMR) vaccine was carried out at day care centers, orphanages, and all health posts. In rural areas, vaccination was done house-to-house. Overall coordination and procurement of vaccines for the campaign was handled by Venezuela's Ministry of Health. Central and state authorities shared the financing of the delivery of immunization services.

In 1992, Venezuela experienced a large measles epidemic, with 22,321 confirmed cases and 77 deaths. This lasted until early 1994 with 16,561 cases and 47 deaths. In 1994, the country carried out a catch-up vaccination campaign targeting the entire population between 9 months-14 years of age, reaching 98% coverage. Between 1994-1996, vaccination coverage through routine immunization services has averaged about 75%. Since the catch-up campaign there has been a steady decline in the number of confirmed measles cases, from 172 in 1995, to 89 in 1996, and to 27 in 1997. As of July 18 (epidemiological week 28), Venezuela had reported 452 suspected cases, but none had been reported as confirmed measles cases. Nevertheless, the growing number of susceptible children has prompted the Health Ministry to undertake a measles follow-up campaign.

Measles Outbreaks in Argentina and Bolivia

Bolivia is currently experiencing a measles outbreak in the areas bordering Argentina, which started May 21. The outbreak has affected primarily the municipality of Yacuiba, in the department of Tarija. The municipality of Yacuiba, especially its localities of Yacuiba and Pocitos, borders the province of Salta in Argentina. In this area, there is a heavy flow of people crossing from Argentina to Bolivia to shop. As of July 24, there were 49 suspected measles cases: 22 in Pocitos, 24 in the area of Yacuiba, and 3 in the area of El Palmar. Of the 49 cases, 28 had serum samples taken, of which 18 tested positive. The population group most affected in the initial stages of this outbreak was that between the ages of 1-4 years. A follow-up measles vaccination campaign targeting all children under 6 years of age, regardless of their vaccination history, was held in the localities of Salvador Masa (Argentina) and Pocitos and Yacuiba (Bolivia) between June 1-21. As of August 10, Argentina had reported 1,874 confirmed measles cases, with 11 deaths, six of these under the age of 1. The first cases appeared in August 1997, in the province of Misiones, which borders both Paraguay and Brazil, then spread to the capital city of Buenos Aires and surrounding areas. Detailed information on these outbreaks and final vaccination coverage data from Venezuela will be forthcoming in the next issue of the *EPI Newsletter.*

Follow-up campaigns are now critical

The successful completion of the measles eradication goal by the year 2000 will require the implementation of PAHO's recommended vaccination strategy in its entirety in all countries of the Region. The objective of the strategy is the prevention of measles outbreaks. It is far more efficient and less costly to prevent an outbreak than to be forced to attempt to control one. In addition to achieving high levels of measles vaccination of children at 12 months of age through routine health services, all countries should conduct follow-up campaigns targeting all children 1-4 years of age, regardless of prior vaccination status or disease history, at least every four years to assure the highest possible level of measles population immunity. Health authorities in the Region need to ensure that sufficient resources are allocated for follow-up measles vaccination campaigns, and that surveillance for the disease is strengthened in order to reach the eradication goal.

As reported previously, there are several countries overdue for a follow-up campaign or are due for such a campaign in 1998. Countries overdue for a campaign are at an increased risk of a measles outbreak and should conduct follow-up campaigns as soon as possible. These countries include: Cuba, Dominican Republic, Ecuador and Haiti. Countries that should conduct a follow-up campaign during 1998 include: Bolivia, Guatemala, Paraguay and Uruguay.

October 1998
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Measles Update

Argentina

As of 9 October 1998, Argentina had reported 6,257 confirmed measles cases. Of the total cases reported, 5,588 (89.3%) occurred in the greater Buenos Aires metropolitan area, with 4,175 (66.7%) occurring in infants and children <5 years of age. While precise figures are not yet available, most cases of measles in children between 1-4 years of age have been among the unvaccinated. To date, 30 measles related deaths have been reported; mostly in infants and children <2 years of age.

Among the cases reported from greater Buenos Aires, the highest age-specific incidence rates occurred among infants <1 year of age (906 cases/100,000 population), followed by children 1-4 years of age (194 cases/100,000), children and adolescents 5-19 years of age (29 cases/100,000), and persons 20 years of age or older (13 cases/100,000).

Outbreak control measures included lowering the age of measles vaccination in affected areas to 6 months of age, vaccinating susceptible contacts of suspected measles cases, and completing the measles follow-up campaign. The campaign was started in May 1998, and is targeting children 2-5 years of age.

Editorial Note:
Argentine health authorities are continuing the outbreak investigation. Preliminary information indicates that although the reported routine infant measles vaccination coverage has been over 95% since the catch-up campaign in 1993, the large number of cases occurring in unvaccinated preschool-aged children strongly suggests that there were large pockets of children who were not reached for measles vaccination.

The source of the outbreak has not been definitely determined, but it is suspected that measles virus may have been imported from the large measles outbreak in southern Brazil in late 1997. Genetic analyses of measles virus isolates obtained from the Argentina outbreak will be conducted at the Centers for Disease Control and Prevention in Atlanta, Georgia, USA. Information from these analyses should provide useful information concerning the potential geographic source of measles virus responsible for the current outbreak.

Similar to the large outbreak that occurred last year in Sao Paulo, Brazil, this outbreak again demonstrates the extreme infectivity of the measles virus and the importance of achieving and maintaining high levels of routine measles vaccination coverage and of conducting timely follow-up campaigns with high coverage. Moreover, these outbreaks again demonstrate that large cities with high population density are areas at high risk for measles importations and outbreaks. Increased efforts are needed to assure high measles immunity in infants and preschool-aged children, especially those living in urban environments.

Haiti

Haiti is currently conducting a follow-up measles vaccination campaign targeting approximately 1.2 million children between the ages of 1-5 years. The campaign started early July in a southern province. On September 20, the first of two campaigns was conducted in the metropolitan area of Port-au-Prince. In spite of the passage of Hurricane Georges in late September, vaccination activities were only delayed by a couple of weeks, and the second part of the campaign was carried out between October 11 and 18. By the end of October, all urban areas will have been vaccinated. The campaign will also include immunization against polio, DTP, and the delivery of vitamin A supplements. Vaccination against tetanus toxoid is also offered to women of childbearing age.

The last case of confirmed measles in Haiti occurred in 1994, the year a catch-up campaign was conducted. Since then, there has been a rapid accumulation of susceptible persons to measles due to low routine vaccination coverage. The Ministry of Health has developed a dual strategy that aims at covering susceptible populations with the current campaign, and increasing routine vaccination coverage. Among the campaign's partners and donors are USAID, the Government of Japan, and UNICEF. PAHO/SVI has provided technical assistance towards this effort.

Paraguay

The national campaign was inaugurated October 15, by the President of Paraguay, Mr. Rául Cubas Grau, the First Lady, Mrs. Mirta Gusinky de Cubas, the Health Minister, Dr. Carmen Frutos de Almada, and other government and health officials. The Ministry of Health and Education signed an agreement to promote and disseminate information on the campaign at schools throughout the entire country.

Paraguay is conducting a country-wide follow-up measles vaccination campaign October 19 through November 30th, aimed at children between ages of 6 months to 14 years. The campaign will begin in densely populated urban areas and will then spread to other regions. Total population to be vaccinated is 2,137,274 children, which represents 40% of the population (50% of the target population lives in urban areas). The first phase the campaign will focus on preschool and school-aged children, orphanages, juvenile detention centers, and commercial centers. Between November 1-30, the Ministry has planned door to door mop-up vaccination in all areas that failed to reach 100% vaccination coverage during the initial phase of the campaign.

December 1998
Volume XX, Number 6

Measles in the Americas, 1998

Through December 21, 1998, a total of 26,103 suspected measles cases had been reported from the countries of the Americas. Of the total reported suspected measles cases, 9,628 (37%) were discarded after a complete epidemiologic and laboratory investigation, 9,598 (37%) were confirmed as measles and 6,877 (26%) suspected cases remained under investigation.

Although the 1998 data are not yet complete, there has been an 82% reduction in measles cases when compared to the 53,661 total confirmed measles cases reported during 1997 (Figure 1). Of the total confirmed cases, 9,005 (94%) had either laboratory confirmation of measles infection or epidemiologic linkage to a laboratory confirmed measles case, and 590 cases (6%) were confirmed on clinical grounds alone.

Together, Argentina (7,054 confirmed cases) and Brazil (2,006 confirmed cases) have accounted for 94% of the total confirmed measles cases in the Americas during 1998 (Figure 2). Other countries documenting significant measles virus circulation include Bolivia (351 confirmed cases), the United States (86 confirmed cases) and Paraguay (68 confirmed cases). Combined, the other countries of the Region have reported a total of 33 confirmed measles cases; several of these cases were international importations and the others were isolated in both time and place.

During 1998, the largest outbreak in the Region occurred in Argentina. Of the total

Editorial Note:
It has been now been over 4 years since the goal of measles eradication from the Americas was established at the 1994 Pan American Sanitary Conference. While great progress has been made towards achieving the goal with a marked reduction in the annual number of reported cases, the measles virus continues to circulate in several countries of the Region. Thus, it seems appropriate to pause and summarize several of the lessons-learned from the experience of the Americas in interrupting measles virus circulation, and to take appropriate actions.

Measles vaccine is very effective in preventing measles, if used

A single dose of measles vaccine has been repeatedly demonstrated to be >90% effective in protecting an individual from measles infection. However, the vaccine is only effective if it is administered to a susceptible infant as soon as possible after the first birthday. For measles eradication, annual routine measles vaccination coverage must be at least 95% in every area of every country of the Region and follow-up campaigns must be conducted among children 1-4 years of age at least every four years.

PAHO's measles eradication strategy (catch-up, keep-up, follow-up) is very effective in preventing measles outbreaks, when fully implemented

Countries that have properly implemented PAHO's recommended vaccination strategy for measles eradication have been successful in rapidly interrupting virus circulation and maintaining its interruption over time. A major contributing factor to the relative resurgence of measles observed in Brazil and Argentina during the years of 1997-1998, has been the failure to fully implement the measles eradication strategy. Complacency is clearly a major obstacle to achieving the goal of measles eradication.

Outbreak prevention is far better than outbreak control

Once measles virus has been re-introduced into an area and measles circulation has commenced, it is virtually impossible to stop an outbreak by rapidly implementing emergency measles vaccination. The virus can circulate much faster than any public health response, and it will result in a large outbreak and thus a "natural" immunization campaign with high coverage.

Measles circulates best in urban areas

The high population density of cities greatly facilitates measles virus circulation between infected and susceptible individuals, especially when the number of susceptible infants and children is high due to low routine measles vaccination coverage. Increased efforts are needed to assure high measles population immunity among infants and children living in urban areas. This can be achieved by obtaining high measles vaccination coverage through routine measles vaccination services, and by the full and timely implementation of follow-up measles vaccination campaigns.

Measles kills susceptible infants and children

Although there were no reported measles deaths in the Americas during 1995 and 1996, the recent measles outbreaks in Brazil and Argentina again demonstrate the lethality of measles virus. Over 100 measles-related deaths were reported during 1997-1998 in these two countries; most of them occurred among unvaccinated infants and preschool-aged children.

The epidemiology of measles is changing; certain groups of young adults are at relatively high-risk for measles

Over half of the cases in the large 1997 measles outbreak in São Paulo, Brazil occurred in unvaccinated adults 20-34 years of age. These persons were born too early to have received the measles vaccine through routine health services, yet too late to have been exposed to circulating measles virus. Many of the young adults who acquired measles in São Paulo belonged to clearly defined risk-groups which included: health care workers, military recruits, university students, persons working in the tourist industry, international travelers, institutionalized populations and migrant workers from rural areas living in work camps. Increased efforts are needed to target and vaccinate young adults who are members of high-risk groups, especially those living in densely populated urban areas.

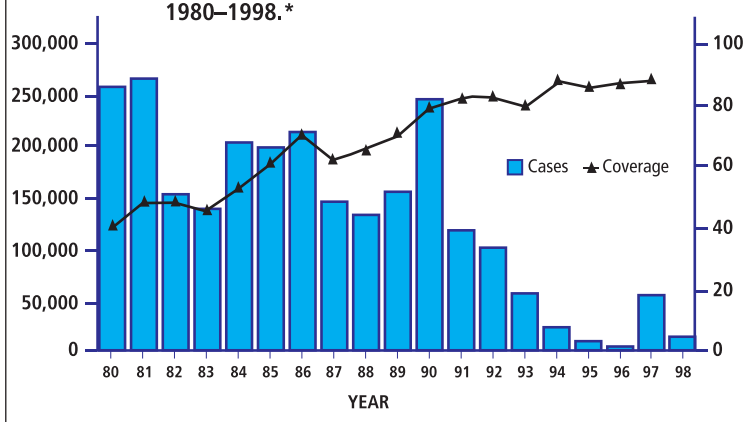
Measles does not respect national or state borders

While measles virus circulation has been greatly reduced in the Americas, the virus continues to circulate freely in the other regions of the world. With the recent major increases in the availability and accessibility of international air travel and an estimate of over 1,000,000 persons crossing international borders globally on a daily basis, there is a constant risk of the introduction of measles virus from measles endemic areas to countries which have been successful in interrupting measles virus circulation. For the Americas to achieve its measles eradication goal, increased efforts are needed to improve measles control and to progress towards measles eradication in other regions of the world.

Global measles eradication is feasible using currently available vaccines

The experience from the Americas also clearly demonstrates that using currently available attenuated, live measles virus vaccines and utilizing an appropriate vaccination strategy, that regional measles eradication can be achieved. The full implementation of an appropriate vaccination strategy in every region will result in the interruption of measles virus circulation from every region, and finally the global eradication of measles virus.

FIGURE 1 Reported measles cases in the Region of the Americas, 1980–1998.*

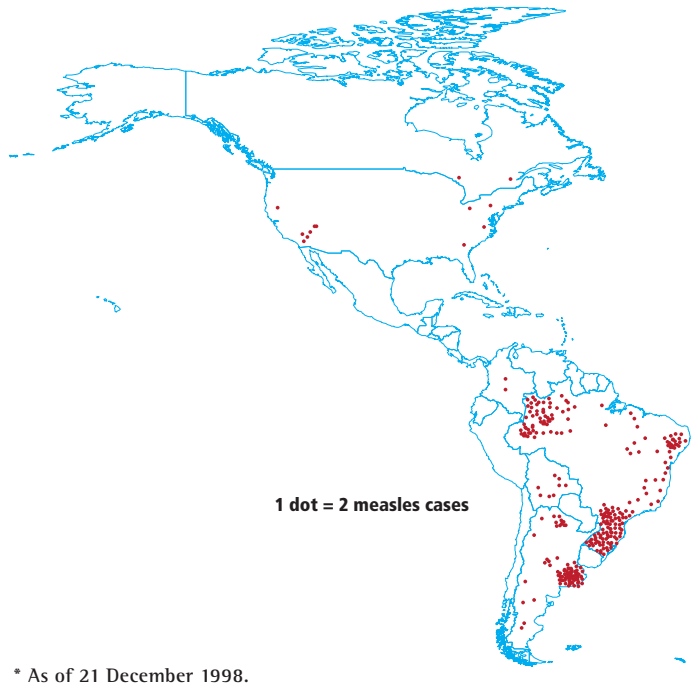


* As of 21 December 1998.
Source: PAHO.

reported cases in Argentina, 6,026 cases (85%) have been reported from the Greater Buenos Aires metropolitan area. Of the total Buenos Aires cases, 4,239 (60%) occurred in infants and children <5 years of age, the overwhelming majority of whom were unvaccinated against measles. Other provinces in Argentina reporting large numbers of measles cases include: Tucumán (212 cases), Misiones (177 cases), Chaco (97 cases) and Jujuy (93 cases). Through December 21, there had been 56 measles related deaths reported, mostly among unvaccinated infants and preschool-aged children.

In Brazil, during 1998, most measles virus circulation has occurred in the south and southeast regions of the country, although cases have been reported from all regions.

FIGURE 2 Confirmed measles cases by state or province, Region of the Americas, 1998.



* As of 21 December 1998.
Source: Country Reports.

States reporting large numbers of confirmed measles cases include: Parana (804 cases), São Paulo (403 cases), Amazonas (258 cases), Pernambuco (166 cases) and the Federal District (144 cases). In contrast to Argentina where the majority of cases have occurred among unvaccinated preschool-aged infants and children, most cases in Brazil have occurred among unvaccinated young adults.

December 1998
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Follow-up Measles Campaign in the Dominican Republic

Six weeks after sustaining significant damage from Hurricane Georges, the Dominican Republic carried out a national follow-up measles vaccination campaign on November 6-12, targeting 29 provinces and the capital city. The campaign was the first mass vaccination effort in the country, following the initiation of decentralized delivery of health services.

Priority was given to vaccinating against diphtheria, whooping cough, and tetanus, especially in refugee camps. Over half a million vaccines were administered to different age groups in these areas. Almost 100,000 of those immunized were under five years of age.

The follow-up campaign was carried out in three stages: the first one was held in areas where health services had not been severely affected by Hurricane Georges. These included ten provinces in the northern part of the country. Next were the provinces in border areas and those nearby, and finally the provinces of the eastern part of the country and the capital city (five municipal health centers). Following the recommendations of a recent nutritional evaluation, the latter two areas provided vitamin A supplementation to children 6 months to 5 years of age, as well as to mothers in the postpartum period or early lactation.

The target population of the follow-up campaign was 830,517 children between the ages of nine months and five years, regardless of their vaccination status. It took only three days to immunize approximately 70% of the target population in each area. Vaccination activities were continued until all the remaining target population was reached. The opportunity was also used to immunize children ages 2 months through 2 years against poliomyelitis. So far, no important side effects have been reported.

The last measles cases in the Dominican Republic were reported at the end of 1994 (a clinical case with serology confirmation, but without epidemiological link occurred in

Dr. Altagracia Guzman, Minister of Health, administers a dose of measles vaccine to the 22-month old son of Dr. Socorro Gross, PAHO's Country Representative in the Dominican Republic. The boy had already been vaccinated. This gesture was to show that all children ages 1-4 years needed to be immunized in the campaign regardless of their previous vaccination status.

The use of the combined measles-rubella (MR) vaccine in the different vaccination strategies, such as mass adolescent and adult vaccination campaigns and follow-up campaigns, has allowed the Region of the Americas to maintain measles elimination.

1997). However, at the end of 1998, it was estimated that the cohort of susceptible persons (unvaccinated and vaccinated but not immunized) under 5 years would equal a birth cohort for that year. This situation prompted health officials to undertake the national vaccination campaign, which was endorsed by the country's medical societies and those international agencies currently supporting the national immunization program.

The Government of Mexico, through its Ministry of Health showed solidarity by donating 300,000 doses of measles vaccine. Other vaccines required for the campaign were obtained through the PAHO Revolving Fund for Vaccine Procurement.

The slogan for the follow-up campaign: "Together we will...Eradicate Measles," was disseminated widely throughout the entire country. The decentralized implementation of the campaign allowed for the active participation of the population. This resulted in high vaccination coverage rates, which will guarantee the protection of the most vulnerable groups and act as a barrier to stop the spread of any outbreak.

1999

February 1999
Volume XXI, Number 1

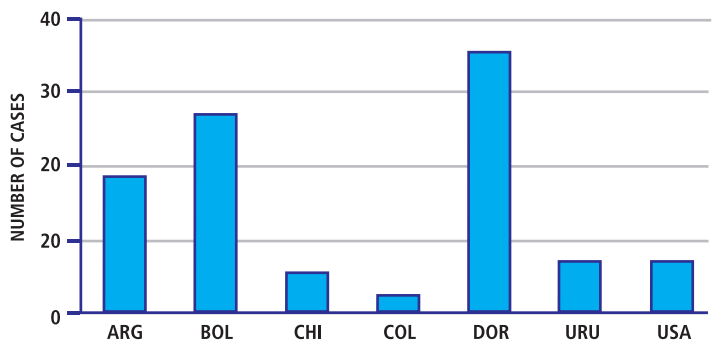
Update: Measles in the Americas

For the first six weeks of 1999, there have been 114 confirmed measles cases reported from seven countries (Argentina, Bolivia, Chile, Colombia, Dominican Republic, Uruguay and the United States) in the Region (Figure 1). Up to February 13, the Dominican Republic has reported 34% of all cases to date. This outbreak was detected in mid-December 1998, but the first cases appeared to have occurred early November 1998. Investigation of the outbreak is underway, to determine possible sources of infection. The preliminary investigation of this outbreak indicates that the majority of the 39 confirmed cases occurred in non-vaccinated individuals that were eligible for vaccination. Therefore, these cases were preventable. The last laboratory-confirmed case of measles in the Dominican Republic occurred in 1997 in a tourist.

Bolivia's year end data show a total of 985 confirmed cases for 1998. Up to February 13, 1999, a total of 122 confirmed cases have been reported, of which the majority of cases are found in the Departments of Cochabamba and Santa Cruz. Investigation of the outbreak in Cochabamaba (1998-99) shows that 85% of all confirmed cases are in children under five years of age (n=156) who were not vaccinated during the follow-up campaign held in 1998. Vaccination efforts have been slow in this department, especially in the large urban areas of the city of Cochabamba. As a result the Ministry of Health is conducting an aggressive mop-up effort, in order to reduce the number of susceptible persons to measles.

All countries in the Region must monitor the build-up of susceptible persons as a result of either low vaccination coverage in routine programs or a less than adequate coverage in follow-up campaigns. In addition, maintaining a sensitive surveillance system and implementing aggressive case investigations of all suspected measles cases is critical if a country is to confront possible importations of measles from neighboring countries or from other regions of the world where the disease circulates widely. These steps should prevent the reestablishment of measles virus circulation in the Region. In Bolivia, the first cases of confirmed measles were due to importations from a neighboring country with a measles outbreak, and in the Dominican Republic measles importation is also strongly suspected.

FIGURE 1 Countries reporting confirmed measles cases, Region of the Americas, 1999.*



* As of 13 February 1999.
Source: Measles Eradication Surveillance System/PAHO.

April 1999
Volume XXI, Number 2

Good Surveillance is Key to Measles Eradication

The goal behind PAHO's recommended vaccination strategy for measles eradication is to maintain the number of susceptible population at the lowest possible level. After the countries have carried out their mass catch-up campaign and progress towards measles eradication, implementing the other two elements of the strategy, keep-up and follow-up vaccination are extremely important in maintaining the number of susceptible persons at the lowest level. Obtaining vaccine coverage better than 95% in every district of any given country is imperative for these vaccination activities to be effective.

As countries reach these milestones, the number of measles cases should dramatically drop. At this point, timely reporting and rapid investigation of each suspected measles case becomes critical to detect further circulation of measles virus in an area. Rapid case investigation of each suspected measles case will allow health workers to determine the source of infection and define the chain(s) of transmission when more than one case occurs in a specific geographic area. Establishing the source of infection is necessary to determine whether the case is due to an importation, or it will confirm that the case is due to indigenous transmission. If there is more than one case of suspected measles in a defined area, establishing the chain(s) of transmission is extremely important, because one can arrive at the source for continued measles transmission, take corrective actions and institute the necessary changes to avoid future program failure.

Figure 1 shows a measles outbreak recently detected in Uruguay. As can be seen, there is a void of epidemiological information and data between the first measles case, which was imported from a neighboring country in week 36, 1998, and the subsequent detection of additional cases commencing in week 50. In 1997, Uruguay reported only one confirmed measles case due to an importation. In week 1 of 1999, another importation was detected along with the other cases for the same period. Because surveillance was not optimal, the reasons for continued transmission of the measles virus were not established. Therefore, the source for the cases occurring at the beginning of week 50 is unknown. However, by the time the second imported case of measles occurred and was hospitalized, measles surveillance was heightened and the surveillance team was able to identify 23 cases that formed four chains of transmission (see Figure 2.) It was determined that in all but one of the four chains, a health worker was either a person transmitting measles infection to others, or the receptor of the infection.

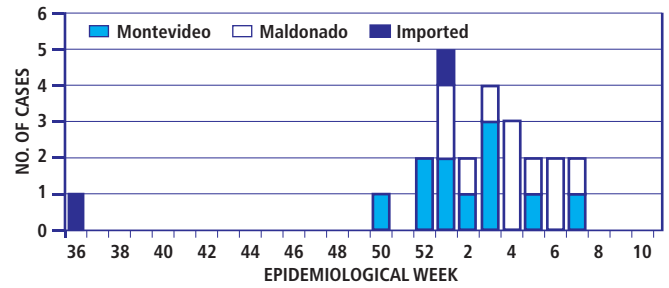
There are 11 cases not shown in Figure 2 that could not be associated with any chain of transmission. However, the investigation of these cases has shown, that they had either traveled to infected areas (mainly by bus), or were employed in businesses associated with tourism, and had come in contact with tourists coming from neighboring endemic countries. The date of onset for these 11 cases all occurred within weeks 1-7, 1999. Furthermore, of the 35 cases only five occurred in children between 0-5 years of age, and there were no cases in the 6-20 years age group. This indicates that the catch-up and the follow-up campaigns implemented by the Ministry of Health were effective.

From Figure 1 the measles outbreak appears short-lived. This is due to the fact that Uruguay has maintained its pool of susceptible persons to an absolute minimum by maintaining vaccine coverage greater than 95% in all phases of the measles eradication strategy (catch up, keep up, and follow up.) Uruguay obtained 95% coverage in their last follow-up campaign carried out in November 1998, and in their routine immunization program (keep up). In order to control the outbreak, the Ministry of Health implemented the following PAHO recommendations: 1) strengthening of surveillance activities in the entire country by alerting departmental health authorities; 2) measles vaccination of all children ages 6-11 months with a booster at 15 months in the entire country; 3) request that all children 14 years and under who were not vaccinated during the last mass campaign be vaccinated against measles; 4) vaccination of all people working in border crossing areas; 5) vaccination of public and private health workers in the department of Montevideo and Maldonado.

From the above, it can be concluded that PAHO's strategy, if implemented in full and coupled with aggressive investigation of suspected measles cases, will assure that measles virus transmission is tracked down until it has nowhere to hide.

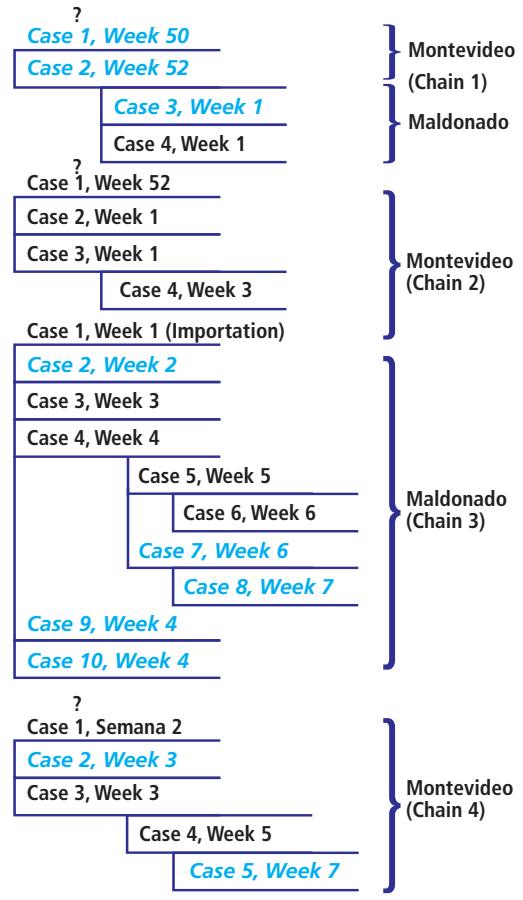
Source: Ministry of Public Health of Uruguay, Division of Epidemiology, Prevention and Control of Diseases, National Immunization Program.

FIGURE 1 Confirmed measles cases in 4 chains of transmission by epidemiological week, Uruguay, 1998–1999.*



* *Source:* Ministry of Public Health, Epidemiology Division, Expanded Program on Immunization.

FIGURE 2 Chains of measles transmission in two departments of Uruguay, December 1998–February 1999.



Total cases in 4 chains: = 23 (66%)
Total cases in outbreak, N = 35
***ITALICS* = Health worker, N = 10 (29%)**

Source: Ministry of Public Health of Uruguay, Division of Epidemiology, Prevention and Control of Diseases, National Immunization Program.

April 1999
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PAHO Publishes Measles Eradication Field Guide

The Pan American Health Organization has released the Measles Eradication Field Guide. The publication, published in both English and Spanish, contains information about all aspects of the disease, including measles epidemiology, clinical aspects, measles vaccines, vaccination strategy for measles eradication, surveillance, and laboratory diagnosis.

During the 24th Pan American Sanitary Conference in 1994, Member Countries established the goal of measles eradication by the year 2000. In 1995, at PAHO's 38th Meeting of the Directing Council, the Ministers of Health of the Americas unanimously approved the Measles Eradication Plan of Action prepared by the Organization.

The Measles Eradication Field Guide provides health authorities, medical officers and other health personnel involved in measles eradication at national, state and local levels with a step-by-step manual for setting up and implementing measles eradication activities. This guide incorporates experiences acquired by the countries of the Americas over the past seven years, but it can be used by any country working towards the control or eradication of measles. It emphasizes appropriate vaccination and surveillance strategies that are required to eradicate measles, and to continually monitor progress towards that goal. Some of the measures described may need to be adapted to local conditions.

PAHO acknowledges the outstanding accomplishment of all health workers in the Americas involved in measles eradication activities. In confronting the formidable challenge of eradicating one of the most infectious and lethal agents known to man, these persons have persevered and continued to learn from their experiences. It is hoped that the lessons learned from the measles eradication experience in the Americas can be adapted and applied in all countries and Regions of the world and that the ultimate goal of global measles eradication can be achieved.

To obtain a copy of the Measles Eradication Field Guide (Technical Paper No. 41), please contact the local PAHO Country Office, PAHO 's Publication Office or the Division of Vaccines and Immunization at 525 23rd Street N.W., Washington, DC 20037, or e-mail us at hvp/hq@paho.org.

June 1999
Volume XXI, Number 3

CDC Joins PAHO to Eradicate Measles

The Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA has joined the Pan American Health Organization to eradicate measles in the Western Hemisphere by the year 2000. On 30 April 1999 at PAHO headquarters in Washington, D.C., Dr. George Alleyne, Director of PAHO, and Dr. Jeffrey Koplan, Director of the CDC signed a collaborative agreement between the two organizations. This partnership will ensure the successful completion of the target of measles eradication and will play a critical role in complementing national efforts towards the prevention, control and eradication of other vaccine-preventable diseases. Dr. Koplan also announced that the CDC will provide US$ 8 million to PAHO for this effort.

Dr. Koplan declared, "CDC looks forward to greater collaboration with PAHO in all areas, and specifically to eradicate measles by the end of the year 2000. This initiative is good for the United States and for CDC, it's good for all the countries in the Americas and for PAHO, and most importantly, it's good for the children of this Region. CDC is committed to ending the sickness and death caused by measles, which can be prevented by an inexpensive vaccine that's been available for more than 35 years. It's no longer acceptable for us to allow measles to continue to take its toll on the most vulnerable members of our societies. I look forward to returning next year for our celebratory meeting here at PAHO."

Dr. Alleyne gave further affirmation to the benefits of this partnership, asserting that "We have the conviction, the firm conviction, that the great things that this hemisphere can do, is when countries work together—that no country is alone."

The experience from the Americas has clearly demonstrated that regional measles eradication can be achieved by using currently available attenuated, live measles virus vaccines, and by utilizing an appropriate vaccination strategy. The PAHO and CDC partnership will focus on strengthening measles surveillance in the Americas and in ensuring that countries implement in full the PAHO-recommended vaccination strategy to eradicate the disease. This partnership will also be critical to advance the adoption and implementation of a global measles eradication goal.

The PAHO-CDC collaboration will be carried out under the framework of PAHO's *Regional Vaccine Initiative* endorsed by all Heads of States in the Americas in 1998. The initiative calls for partnerships among countries in the Region and international organizations in vaccine research, development and production; epidemiological surveillance for vaccine-preventable diseases; and laboratory diagnosis.

Dr. George Alleyne, Director of PAHO (left) and Dr. Jeffrey Koplan, Director of CDC (right) at the signing ceremony at PAHO headquarters.

Specific areas of collaboration include:

- Developing a surveillance system capable of detecting circulation of measles and strengthening collaboration with the global surveillance system to detect and contain infectious disease outbreaks.
- Strengthening national capabilities to effectively prevent, respond and appropriately investigate outbreaks of vaccine-preventable diseases.
- Strengthening annual routine measles vaccination programs at the district level, and full implementation of PAHO's recommended vaccination strategy for measles eradication.
- Strengthening regional and national capabilities to collect, analyze and interpret epidemiological data and translate them into appropriate public health policies.
- Strengthening and expanding capabilities for national laboratory diagnosis and virus isolation.

June 1999
Volume XXI, Number 3

XIII Technical Advisory Group Meeting

The Thirteenth Technical Advisory Group Meeting on Vaccine-Preventable Diseases (TAG) was held in Ottawa, Canada, April 12-16, 1998. The following are some of TAGS conclusions and recommendations.

Measles Eradication

Great progress has been made towards interrupting measles transmission in most countries of the Americas. However, the measles virus continues to circulate in several areas of the Region and only twenty-one months remain until the target date of achieving the goal of hemispheric measles eradication.

Recommendations:

Vaccination Strategies

- The full implementation of PAHO's recommended vaccination strategy in all countries of the Region is needed to assure the eradication of measles from the Americas.
- Routine vaccination of infants (keep-up vaccination) is a critical component of the PAHO measles eradication strategy. Efforts are needed to vaccinate 95% of infants as soon as possible after their first birthday in every district of every country every year.
- Vaccine coverage must be monitored at the district level 3 or geographic equivalent using appropriate denominators for the target population. Supplemental vaccination (mop-up) activities are needed in those districts that do not achieve 95% coverage. These activities may include door-to-door vaccination.
- Follow-up measles vaccination campaigns should be conducted when the estimated number of susceptible children 1-4 years of age approaches the number of children in one birth cohort. In most countries, these campaigns are conducted every four years, but should be held sooner if needed (based on coverage obtained in routine programs and other epidemiologic information).
- In countries with rubella/CRS control programs, measles and rubella-containing vaccines should be used for routine infant vaccination, follow-up campaigns and outbreak response activities.
- Healthcare workers are at increased risk for being exposed to measles virus and for being a potential source of virus transmission in health facilities. Persons working in healthcare settings who have contact with children and persons with infectious diseases should be vaccinated against measles, regardless of disease history or vaccination status. Rubella containing vaccine should be used.

Outbreak response

- Recent experience from outbreaks in Latin America has demonstrated that certain groups of adults may be at increased risk for measles during an outbreak. These groups have also been responsible for sustaining measles outbreaks and for transmitting measles to susceptible persons of other age groups. Since the epidemiologic situation differs between countries, it is not possible to give blanket recommendations about which groups of adults to vaccinate in all countries. When measles virus circulation is suspected, consideration should be given to quickly vaccinate persons within the following groups: teachers, university students, military personnel and persons living/working within institutions such as prisons, large factories, work camps and chronic care medical facilities.
- To obtain information that can be used to prevent and control future outbreaks, appropriate investigations and analysis must be conducted for all measles outbreaks. Efforts are needed to determine sources of measles virus introduction, transmission patterns and specific risk factors for acquiring measles.
- Once measles virus circulation has been confirmed by positive measles IgM serology in several patients, it is not necessary to routinely collect blood specimens from every suspected case. Many suspected cases can be confirmed via epidemiological linkage to a laboratory-confirmed case.

Vaccine Stockpile

- PAHO should assure that a stockpile of measles containing vaccine is readily available to deal with emergency situations. Since many countries of the Americas are establishing rubella control/elimination goals, consideration should be given to having a stockpile of MR vaccine.

Surveillance and Laboratory

- Measles surveillance is critical for measuring progress toward the goal of measles eradication in the Americas and for detecting problem areas. Efforts are urgently needed to improve the quality of measles surveillance throughout the Region.
- To monitor progress toward the achievement of measles eradication, all countries should provide data on a weekly basis to the Region-wide measles eradication surveillance system (MESS).
- Each country should periodically have its measles surveillance system objectively evaluated using the standardized evaluation protocol developed by PAHO. Countries should constantly work to improve the quality of the reporting system.
- Virologic surveillance and molecular epidemiology can provide important information to an eradication program. Appropriate clinical specimens for viral isolation should be obtained from every chain of measles transmission. Urine, the most practical specimen to collect for measles virus isolation, should be obtained within 7 days of rash onset and forwarded to a reference laboratory capable of performing measles virus isolation.

August 1999
Volume XXI, Number 4

Update: Measles Outbreak in Bolivia

Background

Following the establishment of Bolivia's Expanded Program on Immunization in 1979, measles vaccination coverage has progressively increased, reaching a level of 80% in 1993. In 1994, the country joined the regional measles eradication goal for the year 2000 and carried out an indiscriminate catch-up measles vaccination campaign aimed at children 9 months-14 years. The 1994 campaign reached 94% coverage at the national level. Departments failing to reach 80% coverage with measles vaccine were Potosi (78%), La Paz (66%) and Pando (77%).

In 1995, Bolivia's measles vaccination coverage declined to 80% and then climbed to 98% in 1996 and 1997. Partly due to the lack of sufficient vaccines and syringes, coverage fell down again to 85% in 1998. Lowest coverage has been found in the states of Beni, Pando, Cochabamba, La Paz, and Santa Cruz. It should be noted that approximately 70% of the country's population resides in the states of Cochabamba, La Paz, and Santa Cruz. These states also have the largest concentration of urban population.

Due to the accumulation of susceptible children since the 1994 campaign, a follow-up measles vaccination campaign was planned for May 1998, targeting children 1-4 years. However, it had to be postponed for five months due to a lack of vaccines and syringes. The results were modest (85%), mainly because the campaign was organized without sufficient preparation.

Measles Outbreak

The 1998 measles outbreak in Bolivia began on May 21, (epidemiological week 20), following a period of more than 19 weeks without confirmed cases. Initially, the epidemic affected the municipality of Yacuiba, in the department of Tarija. The municipality of Yacuiba, especially its localities of Pocitos and Yacuiba, borders the province of Salta in Argentina and is an area that has a heavy flow of people crossing from Argentina to Bolivia to shop. At the time of the outbreak, Argentina was experiencing an important measles outbreak (10,229 confirmed cases in 1998). From Yacuiba, the outbreak spread first to the city of Santa Cruz in the Department of Santa Cruz, and subsequently to rural areas within this Department, as well as to the Departments of Cochabamba and Oruro. Thereafter, the disease traveled to seven of the country's nine Departments, affecting 66 of 311 municipalities. Eventually, the outbreak affected all departments except Pando.

The population hardest hit in the initial stages of this outbreak was young children. Fifty-seven percent of those affected were children under the age of 5. A mop-up measles campaign targeting children under 5 years, regardless of vaccination history, was first held between June 1-21, 1998 in the localities of El Salvador Masa in Argentina, and Pocitos and Yacuiba in Bolivia.

Current Situation

As of July 10, 1999, 2,254 suspected cases have been reported in Bolivia (since the beginning of the outbreak). Of those cases, 1,871 (83%) were reported from the public sector and 383 (13%) from the private sector. The remaining 4% came from other sources, including 26 cases identified during an active search that took place during the vaccination campaigns in Cochabamba, Sucre and El Alto. Of the suspected cases, a total of 1,836 (81%) were confirmed, 385 were discarded, and 42 are still under investigation. Of the confirmed cases, 1,827 (99%) were laboratory confirmed. Of the 1,836 confirmed cases, 1,004 (56%) occurred in 1998 and 832 during the first 29 weeks of 1999 (Figure 1).

Of the total confirmed cases in 1999, 319 (38%) occurred in children 1-4 years and 150 (18%) in children 6-11 months. A total of 151 cases (18%) occurred in young adults aged 20-29 years (Figure 2). The highest incidence rate occurred in children between the ages of 6-11 months, followed by those aged 12-23 months, 2-4 years and young adults 20-29 years of age (Figure 2). Of the 469 confirmed cases in children aged 6 months-4 years, 408 (87%) had not been vaccinated or could not present proof of measles vaccination, which indicates that failure to vaccinate rather than vaccine failure was the cause of this outbreak. Of the total confirmed cases, 270 (32%) occurred in the state of Santa Cruz, 268 (32%) in Cochabamba, and 200 (24%) in La Paz. The remaining 12% come from states of Oruro, Potosi, Beni, Chuquisaca and Tarija. Of the total confirmed cases, 607 (73%) occurred in urban areas. During the last four weeks, the majority of cases have occurred in the cities of La Paz and El Alto. Although information concerning origin and occupation of the adult cases is still fragmentary, many of these cases are recent migrants from rural to urban areas and market merchants. Adult cases have also occurred among health care workers, students and military personnel living in barracks.

Control Measures

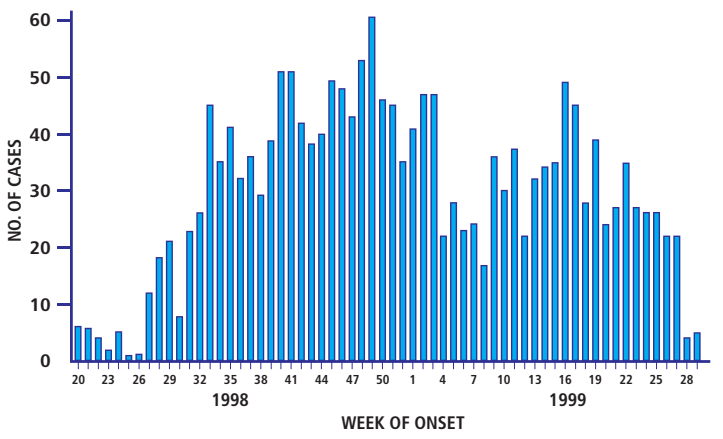
The national follow-up measles vaccination campaign initially planned for April 1998 was postponed due to a lack of vaccines and syringes. The campaign targeting children 1-4 years commenced in October, 1998, five months after the onset of the outbreak, and reached 85% coverage. However, these measures were not enough to stop the epidemic. In spite of a second vaccination campaign starting in March 1999, with all vaccines, the epidemic has continued through 1999. Between June and August 1999, additional measles vaccination campaigns have been implemented, targeting all children 6 months-4 years in the urban areas of Cochabamba, Sucre, Beni, and El Alto and in some rural areas, including El Chapare, and El Pailon and Warnes in the Department of Santa Cruz. These campaigns were combined with an active search of measles cases during which 26 suspected measles cases were found. Due to the

Measles Vaccination Campaigns in the Americas

Region	Country/ Territory	Campaign 1-14 (Catch-up)		Average routine coverage	Campaign 1-4 (Follow-up)		Next Follow-up
		Year	Coverage (%)	1994-1998 (Keep-up)	Year	Coverage (%)	Due
Andean	Bolivia	1994	98	92	1998	85	2002
	Colombia	1993	96	85	1995	90	1999
	Ecuador	1994	100	74	1998	96	2002
	Peru	1992	75	89	1997	97	2001
	Venezuela	1994	100	77	1998	93	2002
Brazil	Brazil	1992	96	87	1997	77	1999
Central America	Belize	1993	82	86	1995	85	2000
	Costa Rica	1993	75	92	1998	87	2002
	El Salvador	1993	96	92	1996	82	2000
	Guatemala	1993	85	75	1996	60	1999
	Honduras	1993	96	92	1996	85	2000
	Nicaragua	1993	94	88	1996	97	2000
	Panama	1993	88	89	1996	94	2000
English-speaking	Anguilla	1991	99	96	1996	100	2000
Caribbean	Antigua and Barbuda	1991	96	97	1996	92	2000
	Bahamas*	1991	87	92	1997	96	2001
	Barbados	1991	96	96	1996	91	2000
	British Virgin Islands	1991	88	100	1996	90	2000
	Cayman Islands	1991	85	93	–	–	–
	Dominica	1991	95	100	1996	100	2000
	Grenada	1991	98	93	1996	81	2000
	Guyana	1991	94	87	1996	90	2000
	Jamaica	1991	71	90	1995/6	95	1999
	Montserrat	1991	100	100	1996	100	2000
	St. Kitts and Nevis	1991	98	99	1996	100	2000
	St. Lucia	1991	97	91	1996	85	2000
	St. Vincent and Grenadines	1991	97	100	1995	84	1999
	Suriname	1991	89	80	1997	100	2002
	Trinidad and Tobago	1991	90	88	1997	96	2001
	Turks and Caicos	1991	81	99	1996	95	2000
Latin Caribbean	Cuba	1987	98	100	1993	99	
	Dominican Republic	1993	77	85	1999	99	2004
	Haiti	1994	94	29	1999	...	**
Mexico	Mexico	1993	88	92	1998	96	2002
Southern Cone	Argentina	1993	97	80	1998	98	2002
	Chile	1992	99	94	1996	100	2000
	Paraguay	1995	70	74	1998	99	2002
	Uruguay	1994	95	88	1998	95	2002

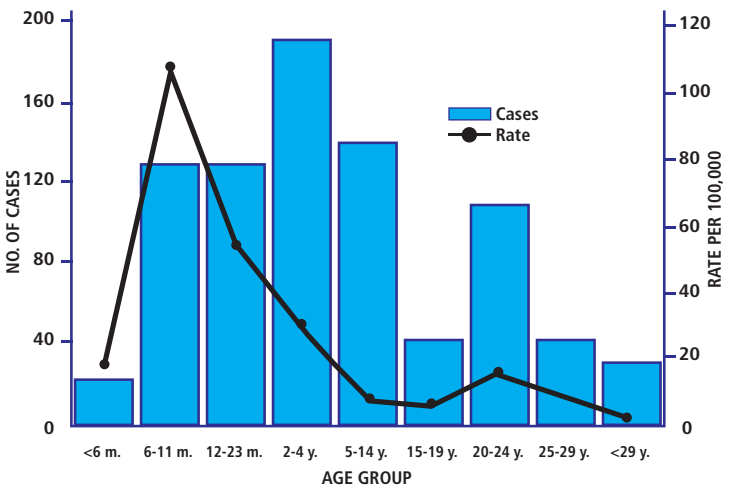
... Data not available.
– No campaign.
* Bahamas = Age group was 4-40 years = 67%, but coverage for the 4-14 years was 96%.
** Follow-up campaign ongoing, last updated: 30 July, 1999.

FIGURE 1 Confirmed measles cases by week, Bolivia, 1998–1999.*



* Up to epidemiological week 28.
Source: Ministry of Health, Bolivia.

FIGURE 2 Number of confirmed measles cases and incidence rate by age group, Bolivia, 1998–1999.*



* Up to epidemiological week 28.
Source: Ministry of Health, Bolivia.

Editorial Note:
The Bolivia outbreak has primarily affected children between the ages of six months and four years living in urban areas. Detecting measles virus circulation in all areas of the country is critical, since it allows for the rapid implementation of control activities that will result in decreased virus transmission. In this regard, it is encouraging to see the growing participation of Bolivia's private sector in reporting suspected measles cases.

The main factors contributing to the persistent and ongoing transmission of measles virus in the country are: 1.) lack of permanent and sufficient supply of measles vaccines; 2.) failure to carry out a follow-up measles vaccination campaign on time; and 3.) low vaccination coverage through routine immunization services.

The situation in Bolivia clearly shows the difficulties in controlling an outbreak once it is fully blown, particularly in densely populated areas. In order to prevent this situation, routine vaccination coverage should be at least 95% in all municipalities.

The Bolivia experience also emphasizes the importance of adequate planning of vaccination campaigns:

- Sufficient time should be allowed for ample involvement of communities, and for adequate distribution of human and financial resources.
- Special attention should be given to the decentralization of activities, to ensure that health areas take full responsibility for implementation.
- Hours of vaccination should be planned based on the best time to reach target populations.

The Bolivia outbreak, as well as other outbreaks occurring in several countries in the Americas (Argentina, Brazil and the United States) that had been free of measles for prolonged periods of time, demonstrates the inevitability of measles re-introduction as long as the virus circulates in other regions of the world. These outbreaks will be short lived in countries with high vaccination coverage through routine services and timely follow-up campaigns. However, in countries with low measles coverage in routine services and where follow-up measles campaigns are not carried on time and fail to reach sufficient coverage, the re-introduction of measles can have severe consequences.

lack of reliable official coverage data, vaccination coverage of these last campaigns has been validated by cluster surveys carried out on the same day as the vaccination campaigns. Following these last vaccination efforts, coverage has reached more than 90% in Cochabamba, Beni, and Sucre. In these areas where vaccination coverage was high during the campaign, there was a dramatic drop in cases. Nonetheless, campaign coverage was low in El Alto and cases have continued to occur there and in La Paz, which is located next to El Alto. A mop-up vaccination campaign has been reinitiated in El Alto. At this time, a vaccination campaign targeting children aged six months to four years is being held in La Paz, with the collaboration of international partners, as well as government and non-governmental organizations.

October 1999
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Bolivia: All Out Fight Against Measles!

Since May of 1998, Bolivia has been affected by a measles outbreak, which began in the municipality of Yacuiba, within the department of Tarija (see *EPI Newsletter,* August 1999). Bolivia reported 1,004 confirmed measles in 1998, and during the first 40 weeks of 1999, there have been 1,218 confirmed cases. Fifty-one percent of the total measles cases for 1999 in the Region have been reported in Bolivia.

In response to this situation, the Ministry of Health of Bolivia has prepared a special plan of action and issued a Ministerial Resolution on October 26, aimed at ending the outbreak and interrupting virus transmission. The objective is to vaccinate at least 95% of all children between the ages of 6 months and 4 years (1,071,723 children) in a National Measles Vaccination Campaign, to be held between 28 November and 17 December in each municipality. This decision of the Ministry of Health indicates the high-level commitment of national authorities to the health of the population, and is an excellent example of Pan-Americanism in action.

Ministerial Resolution

Considering,
That, the Bolivian Government, together with other governments of the Americas, has made the commitment to eradicate measles from the Western Hemisphere by the year 2000. That, the measles outbreak, which began in Brazil in 1997, has spread to our territory. That, it is necessary that the Ministry of Health and Social Welfare take the necessary measures to protect the health and life of all their people, especially that of children.

Therefore,

Resolves,
First Article. Declares of national priority the implementation of a National Campaign against Measles, to be scheduled between November 28 and December 17 of the present year, during which at least 95% of the children between the ages of 6 months and 4 years of age should be vaccinated, in order to interrupt the transmission of the disease.

Second Article. Charges the Directorate General of Epidemiology with managing the implementation of the technical and resource mobilization aspects, and the allocation to the departmental health services of vaccines, syringes, registration material, national and international financial resources, as well as follow-up and evaluation of the campaign.

Third Article. The Departmental Health Services should assume the responsibility of local planning, promotion and implementation, and the accomplishment of 95% coverage of measles vaccination at the departmental level. Towards this end, maximum priority should be assigned and human material and financial resources allocated to successfully reach this goal.

Fourth Article. The Departmental Health Services should summon health providers from the social services, non-governmental organizations and health services of the Church to join this national task. The Departmental Health Services will provide vaccines, syringes and registration material.

Fifth Article. During the preparation and implementation of the Campaign, all activities that could jeopardize its implementation will be suspended. Furthermore, vacations and permission of the management and operational staff involved in the Campaign will be suspended.

Sixth Article. The Departmental Health Services that do not reach the target of 95% measles vaccination for children between 6 months and 4 years of age will be subject to sanctions as stipulated in their management performance agreements.

Those responsible for the fulfillment of this resolution are the Heads of the Departmental Health Services and the Directorate General of Epidemiology.

Register, make this known, and archive this document.

October 26, 1999

October 1999
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Measles in the United States

Since the measles epidemic which spread across the Western Hemisphere in 1989-1991, measles vaccination activities have accelerated in the United States, resulting in record low incidence levels over the past 6 years. Accelerated vaccination activities in other PAHO member countries have also contributed substantially to the reduction of measles incidence in the United States. The United States shares the PAHO goal of measles elimination by the year 2000. The target for the United States is the elimination of measles as an indigenous disease (no continuous indigenous chain of measles transmission). Limited indigenous transmission is expected to occur as a result of imported measles cases.

The Measles Elimination Strategy for the United States has four components: 1) maximize population immunity to measles by delivering the first dose of measles-mumps-rubella vaccine on time (at 12- 15 months of age) and giving a second dose to children at school entry, 2) ensure adequate surveillance, 3) respond rapidly to outbreaks and 4) work with other countries to improve measles control.

The first dose has been at 90% for two-year old children since 1996. First-dose coverage among all school children exceeds 97% because of long standing, well-enforced, school requirements for vaccination. School requirements in the states have been gradually modified to include a mandatory two doses of measles vaccine. As of the 1998-99 school year, two doses of measles vaccine were required for 57% of school children in the United States (two doses are recommended for all school children).

The sensitivity of the United States Measles surveillance system is shown by its ability to consistently detect internationally imported measles cases. In addition to rapid detection of cases and prevention of spread, the surveillance system focuses on linking cases to international importation of measles virus. Internationally imported cases, cases epi-linked to importation, and imported virus cases (cases in a chain of transmission from which an imported measles virus strain was isolated but a link to an internationally imported case was not identified) are all considered importation-associated cases. Of the record low 100 cases reported in 1998, 26 were internationally imported, 45 were importation-associated, and 29 were not importation-associated. The proportion of cases not associated with importation has declined from 85% in 1995 to 72% in 1996, 41% in 1997, to 29% in 1998.

The 26 internationally imported cases reported in 1998 represent the lowest number of imported cases since the recording of importation status began in 1983. Imported cases from the Americas remained at very low levels with one imported case from Argentina and one from Canada. Imported cases from Europe and Asia declined compared with the previous 4 years (Figure 1). Of 26 imported cases, 14 occurred among international visitors and 12 occurred among U.S. residents exposed to measles while traveling abroad.

Viral genomic sequencing of specimens in 1998 allowed genotype classification of measles virus strains from

FIGURE 1 Source of measles importations, United States, 1994–1998.

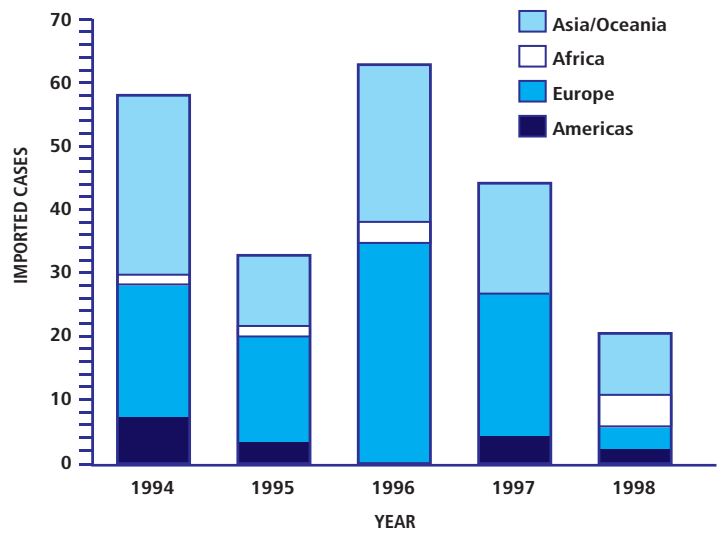

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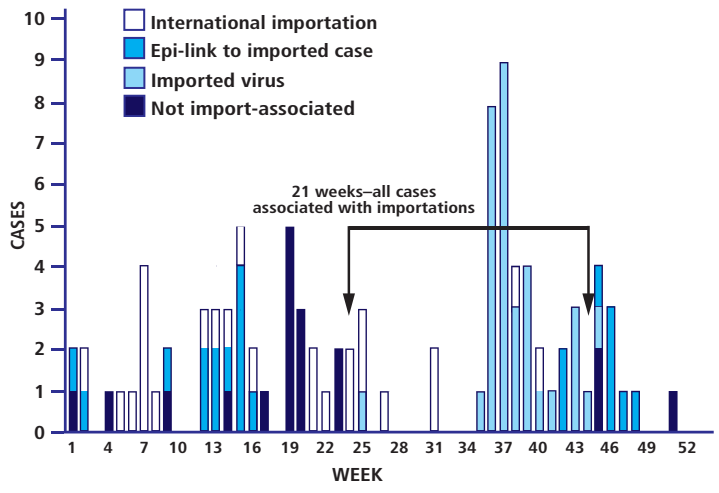
FIGURE 2 Measles cases by importation status and week of rash onset, United States, 1998.



seven chains of transmission. Virus strains isolated from cases in New York, Vermont, California, Massachusetts, and Washington matched viral genotypes from epi-linked source countries Germany, Cyprus, Japan, China, and Croatia, respectively. Measles virus was isolated from an outbreak in Indiana but genotype information was unavailable from Zimbabwe, the source country of the imported case. Measles virus isolated from the Alaska outbreak matched the virus circulating in Japan, the source country of the imported case which occurred four weeks before the outbreak, but no definitive epi-link could be discovered between the imported case and the outbreak.

During 1998, 28 states and the District of Columbia reported no confirmed measles cases, compared with 21 states in 1997. Eight states accounted for 82% of cases: Alaska (33 cases), Arizona (11), Michigan (10), California (nine), New Jersey (eight), New York (four), Pennsylvania (four), and Indiana (three). In the remaining 14 states, two or fewer cases were reported. During 35 weeks, all reported measles cases were importation-associated, including 21 consecutive weeks (weeks 24-44) (Figure 2).

The age distribution and vaccination status of U.S. residents with measles differed from those of international visitors. Most U.S. residents (53%) with measles had been vaccinated with one or more doses of measles vaccine, compared to 14% of international visitors.

Six measles outbreaks (≥3 linked cases) were reported in 1998, the fewest ever reported to the CDC. The 65 measles cases reported from these six outbreaks represented 65% of all cases reported during 1998. The largest measles outbreak reported since 1996 occurred in a high school in Anchorage, Alaska, where high school students were not required to have two doses of measles vaccine (30 of the 33 cases had received one dose of measles vaccine). The total duration of the outbreak was 15 weeks. Following the onset of the outbreak, all students in Alaska were required to have two doses of measles vaccine. Three outbreaks (Arizona, Indiana, and Pennsylvania) were epi-linked to an imported measles case, and two outbreaks (Michigan and New Jersey) were not importation-associated.

Provisional data for 1999 show 73 confirmed measles cases reported from 15 states as of week 41 (October 16), compared to 76 cases for the same time in 1998. Of these provisionally reported cases, 23 (32%) were internationally imported cases, 20 (27%) were importation associated, and 30 (41%) were not associated with importation. Currently 10 cases are under investigation. Of the 9 outbreaks reported to date for 1999, six had an international source. The largest outbreak occurred in Virginia, with a provisional total of 9 cases.

Source: Dr. Mark Papania, Acting Chief, Measles Branch, Centers for Disease Control and Prevention, and Epidemiology of Measles – United States, 1998, MMWR, September 3, 1999, Vol. 48, No. 34, pages 749-753.

Editorial Note:
Epidemiologic data for 1998 suggests measles is no longer an indigenous disease in the United States. Most cases reported in 1998 were associated with importation, including the short chains of indigenous transmission of measles that occurred following international importation of measles.

Cases not associated with importation were insufficient to represent a continuous indigenous chain of measles transmission. Some cases may spread from undetected imported cases of measles. Detecting imported cases is difficult as international visitors with measles may leave the country before the rash appears or before they seek medical care. Even when the imported case is detected, it is difficult to detect every case in the chain of transmission, as was seen in the outbreak in Alaska. This highlights the need to obtain viral specimens from every chain of transmission to supplement epidemiologic information.

The United States appears to have eliminated measles as an indigenous disease. High measles vaccination coverage and strong surveillance remain critical to preventing international imported measles cases from causing a resurgence of measles in the United States.

Measles in Canada

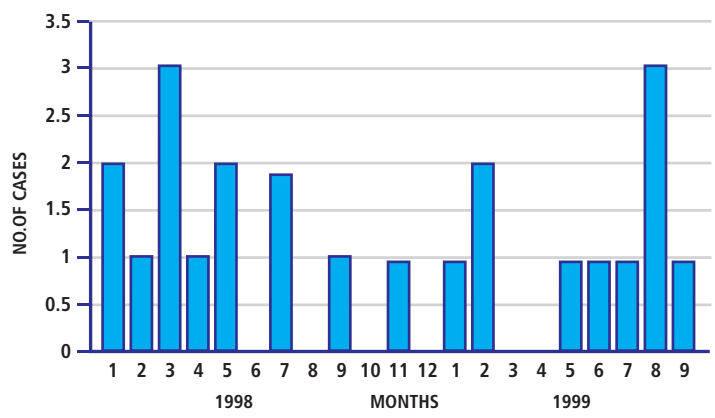
The Laboratory Centre for Disease Control (LCDC), Health Canada, in collaboration with the provincial/territorial public health officials, has introduced an enhanced surveillance system to monitor measles on a more timely basis towards achieving the measles elimination goal. All measles cases, confirmed or clinical (according to the national standard case definitions), are reported electronically by provincial/territorial health departments to LCDC on a weekly basis. Every attempt is made to further investigate all cases using a protocol developed by the National Working Group on Measles Elimination in Canada (WGMEC). Figure 1 shows reported cases of measles in Canada, by month, for 1998 and 1999 (as of September).

In 1998, a total of 12 laboratory-confirmed sporadic cases was reported, the lowest annual number ever recorded in Canada. This compares to 581 cases reported in 1997 and an estimated 300,000 to 400,000 cases occurring annually in the pre-vaccine era. All the 12 reported cases were laboratory confirmed for measles-specific IgM antibodies and verified by the WGMEC. Ages ranged from 9 months to 33 years of age, with a median of 5 years. Two cases required hospitalization. Vaccination histories were available for nine of the cases: seven had at least one dose of measles vaccine, and two cases had none (one due to a medical contraindication and the other because of a 'missed opportunity'). Of the seven vaccinated cases, two were vaccinated before their first birthday (while living outside Canada); four had received one dose, and one had received two doses of measles vaccine. Five (42%) of the confirmed cases had exposure histories outside Canada; exposures occurred in the Bahamas, Pakistan, Uganda and the United States.

In 1999, as of October 1, a provisional total of 10 confirmed cases were reported: 7 laboratory-confirmed and 3 epidemiologically linked to a laboratory-confirmed case in Canada. Nine cases were Canadian residents, and one (index case) was an unimmunized 20-year-old visitor from the Netherlands. This case, with epidemiologic link to an outbreak in the Netherlands in June 1999, developed symptoms while visiting relatives in Canada. Three secondary cases (a 21-year-old sister of the index case and her two children aged 23 months and 11 months) were reported in the host family. All three secondary cases were unimmunized and belonged to a community with known religious objections to immunization. Seven of the 10 cases had exposure to measles outside Canada (India, Indonesia, Japan, the Netherlands, Pakistan, and the Philippines). Five cases were infants less than one year of age who were not eligible for measles vaccination in Canada.

Source: Dr. Paul Varughese, Division of Immunization, Bureau of Infectious Diseases, Laboratory Centre for Disease Control (LCDC) Health Canada.

FIGURE 1 Reported cases by month, Canada, 1998–1999.*



* As of September.

First Ladies Meet in Canada

The Spouses of Heads of State and Government of the Americas and Government Delegates gathered in Ottawa, Canada, from September 29 to October 1, 1999 for the Ninth Conference of the First Ladies of the Americas with the theme of Women of the Americas: Agents of Change. These conferences originated in 1980, when the First Spouses of the Central American countries met to exchange experiences and establish mechanisms for action and cooperation among their countries. By 1991 in Venezuela, the conferences had become an annual gathering, and later turned into a hemispheric event in 1994, when Canada and the United States participated for the first time.

In the 19 point Declaration of Ottawa, the First Ladies reaffirmed their will and determination to contribute to the well-being of the people in the Americas. The First Ladies noted that given the existing global and hemispheric consensus on social development goals, the time was propitious to pursue and consolidate these goals, giving priority to human groups most in need of support and to the problems and social services that require further attention.

In point 8 of their Declaration, the First Ladies made reference to the Regional initiative to eradicate indigenous transmission of measles virus by the year 2000: "We continue to strive toward the promotion of better health through preventive measures, the reduction of violence, and more equitable access to health care services. We praise the achievement of those countries that have successfully eliminated measles and other preventable diseases within their borders and encourage the continued effort of others to meet our common goal of eradicating measles throughout the Americas by the year 2000."

Final Ottawa Declaration - September 29-October 1, 1999, Ottawa, Canada.

Editorial Note:
In 1995, the National Advisory Committee on Immunization reaffirmed its commitment to the goal of eliminating measles, a goal that is shared by all countries of the Americas. Following this, Health Canada in collaboration with the provincial/territorial governments encouraged a mass catch-up vaccination campaign followed by routine 2-dose immunization. This took place during 1996-1997. The campaign targeted 90% of all school-aged children (5 million) in this country and approximately 4 million children have been immunized with a second dose.

The measles experience in Canada in the past 2 years suggests that the 2-dose universal program and the catch-up program introduced in 1996-1997, had a significant impact in the decline of measles incidence, and in the interruption of measles virus transmission in the Canadian population. Most of the cases reported in Canada since 1998 have been imported or import-related.

This achievement is undoubtedly due to the ongoing efforts, vigilance and commitment of health care and public health communities across Canada to increase vaccine coverage rates among children. In addition, the measles elimination effort is supported by an enhanced measles surveillance system, active epidemiological follow-up of cases and contacts, and laboratory support that includes not only confirmatory diagnosis but also molecular characterization of virus isolates, whenever possible.

The proportion of the Canadian population who do not get immunized due to religious, medical, or philosophic reasons is considered to be very low (1%).

December 1999
Volume XXI, Number 6

Year 2000: Zero Measles?

Through December 11, 1999, a total of 39,941 suspected measles cases were reported from the countries of the Americas. Of these, 2,803 (7%) have been confirmed, 28,769 (72%) have been discarded, and 8,369 (21%) remain under investigation. Of the total confirmed cases, 2,227 (79%) have laboratory confirmation of measles infection or epidemiological linkage to a laboratory confirmed case and 576 (21%) have been confirmed on clinical grounds alone. The country most affected by measles in 1999 is Bolivia, with 51% of all reported cases in the Region (1,420 confirmed cases). Other countries with significant virus circulation included: Brazil (689 confirmed cases), Argentina (253 confirmed cases), Dominican Republic (206 confirmed cases). The other 235 cases were reported from the United States, Uruguay, Colombia, Chile, Peru, Costa Rica, and Canada, and were mainly secondary cases following international importations among unvaccinated populations.

Bolivia has continued to suffer large outbreaks in urban areas due to large pockets of under-immunized populations, despite intensified vaccination activities that began in November 1998 and continued through March 1999. The current outbreak, which began in May 1998, produced 1,004 confirmed measles cases in 1998 and appeared to be waning at the end of 1999 (Figure 1). The major foci of measles virus transmission during 1999 were the departments of La Paz (453 cases), Santa Cruz (345 cases), Cochabamba (291 cases), and Beni (149 cases). Beni, a selvatic region of Bolivia with a highly dispersed population, reported the highest incidence rate (42/100,000), with the other three departments reporting incidence rates of 19-20/100,000. Of the total confirmed cases in 1999, 755 (54%) occurred in children under five years of age, and this age group also had the highest overall incidence rate. Of the remaining cases, 336 (25%) were reported in school-age children (5-19 years of age), and 225 (17%) among young adults (20-29 years of age). To control this measles outbreak, the Bolivian government, with the technical support of PAHO, and financial assistance of the World Bank, the Inter-American Development Bank, UNICEF and local NGOs developed an Emergency Plan. Under the Plan, an international team of seven experts was recruited to work with Bolivian health authorities. The Ministry of Health also issued a Ministerial Resolution supporting the implementation of a comprehensive national campaign during December of 1999. A dramatic drop in measles cases has been observed, in the areas undertaking intensive follow-up measles vaccination activities.

A similar situation to that of Bolivia became apparent in the Dominican Republic during 1999. The outbreak began due to an importation from Argentina in 1997 in the tourist area of Altagracia. Despite two vaccination efforts in 1998, the virus continued to circulate and subsequently spread throughout the country in 1999. Over 50% of cases were reported from the Santo Domingo metropolitan area, where pockets of unimmunized children, overcrowding, and low coverage rates from previous follow-up campaigns helped to spread the disease. Like Bolivia, the majority of cases were found in young children. The Ministry of Health, working with PAHO's technical assistance, organized a Task Force to ensure the effective control of measles virus transmission in the country. Furthermore, an international team is working with national health authorities to raise coverage rates in a house-to-house vaccination effort, targeted at children between the ages of 6 months and 4 years.

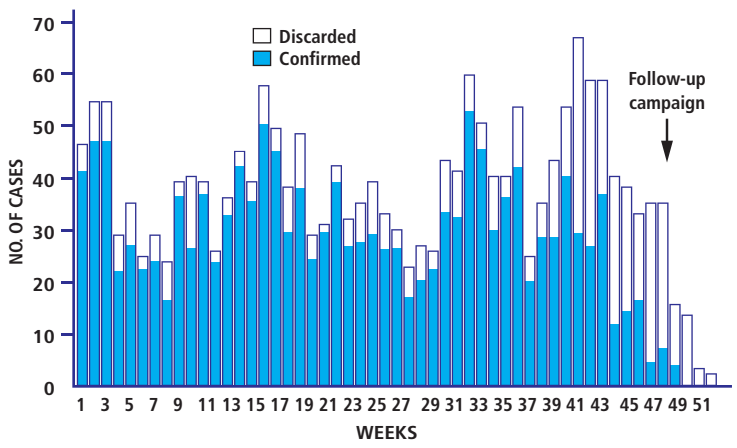
Brazil experienced an impressive decline in measles cases compared to 1998 (a total of 2,930 confirmed cases were reported last year compared to 689 confirmed cases in 1999 through epidemiological week 47). Nevertheless, over 50% of the cases (365) were clinically confirmed, indicating a failure of the surveillance system in conducting a complete epidemiological investigation. The Northeastern portion of the country reported 250 cases (36% of total cases), of which 145 (21%) cases were reported from Pernambuco, with outbreaks in three municipalities. Rio de Janeiro and São Paulo reported 117 and 126 cases, respectively. A recent outbreak was also reported in an army battalion in the state of Mato Grosso do Sul. Age groups most affected have been children under one year of age (incidence of 3.48/100,000), and 1-4 year olds (0.73/100,000).

Argentina, which reported the majority of cases in 1998, notified only 245 cases as of December, 1999. These cases occurred mainly in the provinces of Tucuman, Chaco, San Juan and in the province of Buenos Aires. Age groups most affected were children under one year (7.5/100,000), followed by children one year of age (4.72/100,000), and 2-5 year olds (0.75/100,000). An Emergency Plan of Action was developed in 1999 and four national epidemiologists were hired to assist Argentinian health authorities in eradication efforts. Since mid-September, only four confirmed cases have been reported, indicating a sharp reduction in the transmission of measles virus.

In Colombia, an active search was conducted in the largest eight cities to determine if measles virus was circulating. This action was taken to respond to laboratory confirmed measles cases occurring in isolation in 1998 and 1999, without any known source of infection. PAHO and Health Ministry officials reviewed all available cases and surveillance data for both years and determined that only one department had a clustering of measles cases, especially in an urban area, which suggested measles virus circulation. A review of case and laboratory data from the other sporadic laboratory with confirmed measles cases with no source of infection indicated that the majority of them were post-vaccine associated cases. More importantly, because of the ongoing processes of health reform and decentralization, the quality of measles surveillance is unknown or at best unreliable because many of the new health care providers are not part of the formal national surveillance system. In order to quickly determine if the measles virus was still circulating, the Ministry of Health accepted PAHO's recommendation to carry out an active search in the eight largest urban centers. The active search was carried out between November and December 1999. No additional confirmed laboratory measles cases were found.

Costa Rica reported three imported measles cases traced to a Costa Rican resident exposed to measles while visiting Peru. This person subsequently infected two additional persons in their household. Of note, this adult was the only unvaccinated person for measles in the tour group to Peru, and the other two household members were also unvaccinated. An active search in the hospital where the cases were attended, and in the surrounding area, revealed no spread of the virus. High coverage with measles vaccine in the country was an essential barrier to prevent spread of the virus.

FIGURE 1 Confirmed and discarded measles cases by onset week, Bolivia, 1999.



Source: Ministry of Health, Bolivia.

Editorial Note:

The millennium ends on a high note for vaccine-preventable diseases: smallpox was eradicated worldwide in 1979, poliomyelitis was eradicated from the Western Hemisphere in 1991, and the Region of Americas is on the brink of eradicating the indigenous transmission of measles virus. Since 1997, confirmed measles cases in the Americas have declined 95% from a high of 53,661 cases in 1997, to 2,803 confirmed cases this year. Reaching the final unvaccinated population and breaking the chains of transmission will require the utmost dedication to the eradication strategy if this milestone is to be reached by the end of the year 2000. Vaccination of susceptible individuals is the keystone to success. To achieve measles eradication all countries in the Americas should use the same tools. These tools should include:

- Carry out timely follow-up measles campaigns when the pool of susceptibles approximates the number of children in an average birth cohort.
- Reach the goal of 95% vaccination coverage in all municipalities.
- Assure the availability of the necessary vaccine supply at the central, regional and local level at all times.
- Avoid missed opportunities: all contacts between children and health care workers should be used as an opportunity to vaccinate, when appropriate.
- Identify hard-to-reach population groups and implement social mobilization activities that enhance their compliance with vaccination efforts.
- Alert health care workers about the regional eradication initiative and stress the importance of their cooperation to reach this goal.
- Health care workers in contact with children or infectious diseases should be vaccinated against measles regardless of vaccination history.
- Ensure complete epidemiological investigations of all suspected measles cases. A suspected measles case is any: "Patient in whom a health care provider suspects the possibility of measles."
- Assure that all vaccination activities contemplate the safe disposal and incineration of all needles and syringes.

December 1999
Volume XXI, Number 6

Collection and Handling of Laboratory Samples for Measles Eradication and Rubella Control

Blood samples from suspected cases:

- In outbreak situations, blood samples should be taken from the first few suspected measles or rubella cases of the outbreak and from all other cases that do not occur in the same municipality or district. Samples may also be taken from any atypical or unusual cases. Samples are not needed from cases epidemiologically linked to other already confirmed cases.
- When sporadic suspected measles or rubella cases occur (dispersed geographically and/or in time), blood samples should be taken from every case.
- Blood samples from all suspected rubella cases that are IgM negative for rubella should be tested for measles, ideally within 24 hours* and vice versa.
- Blood samples from at least 10% of the suspected dengue cases with rash that are IgM negative for dengue should be regularly tested for measles.*

Samples for viral isolation from suspected measles cases:

- In outbreak situations, urine samples should be taken from the first few cases of the outbreak (5-10 samples). If attempts to isolate virus are unsuccessful, then additional urine samples should be taken from new cases as they occur. Urine samples should also be taken from cases that do not occur in the same municipality or district. They may also be taken from any atypical or unusual cases.
- When sporadic cases occur (dispersed geographically and/or in time), urine samples should be taken from every case at the first opportunity.
- Whenever urine samples cannot be taken (i.e. in some young children), a wipe of the nose and throat with a sterile swab (nasopharyngeal swab) should be taken instead.
- Ideally, samples for virus isolation should be taken within 1-3 days after rash onset, and no more than 5 days after rash onset. However, for sporadic cases, because there may be limited opportunities to take the sample, samples can be taken up to 7 days after rash onset.
- Samples for virus isolation should be shipped to the laboratory indicated in your country as soon as possible.
- The national laboratory responsible for managing measles specimens will test (or forward to a reference laboratory for testing) the specimens of those cases with measles serum IgM positive results.
- Ideally, only half of the sample should be used for

viral isolation. The other half should be stored at minus 40-70C° as a backup in case of contamination or other technical problems with the sample tested.

Samples for viral isolation of suspected rubella cases:

- In outbreak situations, nasopharyngeal swabs should be taken from the first few cases of the outbreak (5-10 samples). If attempts to isolate virus are unsuccessful, then additional samples should be taken from new cases as they occur. Nasopharyngeal swabs should be used to wipe the nose and throat. The virus is extremely cell-associated, so attempt to swab the throat and nasal passages to collect epithelial cells. Place both swabs (from the nose and throat) in a sterile tube containing 0.5-2 ml of viral transport media.

Storage and transport of samples for viral isolation

- 50-100 ml (1.5-3 ounces) of urine should be taken in a sterile container. If no sterile container is available, a clean container can be boiled and used instead.
- The urine should be kept refrigerated at 4-8C° until it can be centrifuged.
- Ideally, all urine samples should be cold before centrifugation.
- The urine should be centrifuged, ideally on the same day it was taken, at 1500 RPM (about 500 x g) for 5 minutes. A refrigerated centrifuge is not a requirement.
- The pellet should be immediately re-suspended in 0.5-2 ml of viral transport media (VTM).**
- In the field, centrifuged urine and nasopharyngeal swab specimens can be refrigerated at 4-8C° for up to five days until they can be stored in a –70 or –40C° freezer.
- As soon as possible, the sample should be sent to a laboratory equipped with –70 or –40C° freezers. Because of the risk of damaging the viruses, samples should never be kept at –20C°.
- When samples are ready to be sent to the national laboratory, they should be shipped in coolers with ice packs.
- In the case of samples that have been frozen at –70 or –40C°, they must be shipped in dry ice to the national laboratory.
- If for any reason centrifugation is not possible, the urine can still be shipped immediately to the national laboratory in coolers with ice packs. It might still be viable for virus isolation if it reaches the laboratory within five days from the day it was taken.
- In the case of a nasopharyngeal swab, the swab should not be centrifuged. It should be placed in a sterile tube with 0.5-2 ml of VTM.

Information regarding the samples

- Information to be sent with the sample should include the following:
  - unique identifier number (MESS number where available)
  - full address and complete phone number to which results should be reported
  - age of patient
  - date of rash onset
  - date of collection of sample
  - date of last vaccination with a measles-containing vaccine
  - date of last vaccination with a rubella-containing vaccine
  - if the case is sporadic or part of an outbreak.
- Paper documents should be well protected from the ice in a well-sealed plastic bag or similar.
- The laboratory that receives the samples should record the condition of the sample upon arrival (did the container leak?, was there an ice pack?, were the contents kept cold in transit from the point of collection?). This information should be shared with the sender so errors can be corrected in future shipments.

* In the case of laboratory-confirmed rubella or dengue outbreaks, the total number of samples that are negative for either rubella or dengue might be overwhelming. In such a case, the surveillance team, in conjunction with the laboratory, should decide which samples to test for measles.

** VTM should be made available to all health centers by the national laboratory of each country. VTM usually contains sterile phosphate buffered saline (PBS) or suitable isotonic solution such as Hank's BSS, etc., containing antibiotics (100 units/ml penicillin, or 100 mg/ml streptomycin) and either 2% fetal bovine serum or 0.5% gelatin in plastic, screwcap, centrifuge tubes. VTM should be kept either frozen or refrigerated until it is used.

2000

February 2000
Volume XXII, Number 1

On the Trail for Measles in Colombia

What follows is a summary of an active search for measles cases organized by a working group with staff from Colombia's Ministry of Health and National Institute of Health, and the collaboration of PAHO's Division of Vaccines and Immunization. The search was conducted by approximately 880 health care workers between August and November, 1999 and had the objective of determining if indigenous measles virus was circulating in 10 selected cities of Colombia.

Background

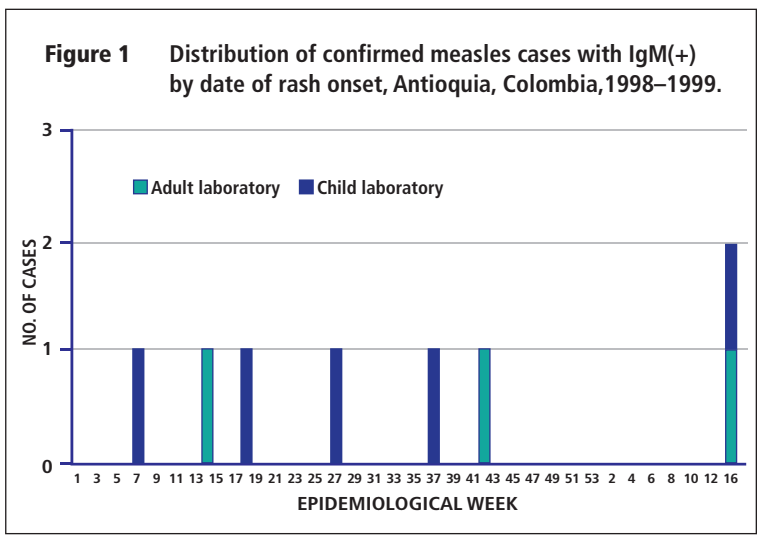
From 1997-1999, Colombia reported 8, 12, and 10 laboratory confirmed measles cases, respectively. Each case was sporadic in both time and location. While some departments had two or more cases annually, these did not occur within the same exact location. Case investigations and active search for additional cases carried out for each case in 1998 and 1999 could not detect source of infection and chains of transmission. From 1997-1999, two departments Cuindinamarca (which includes the city of Bogota) and Antoquia had reported several confirmed measles cases each year. This pointed to continued measles virus transmission in these two departments.

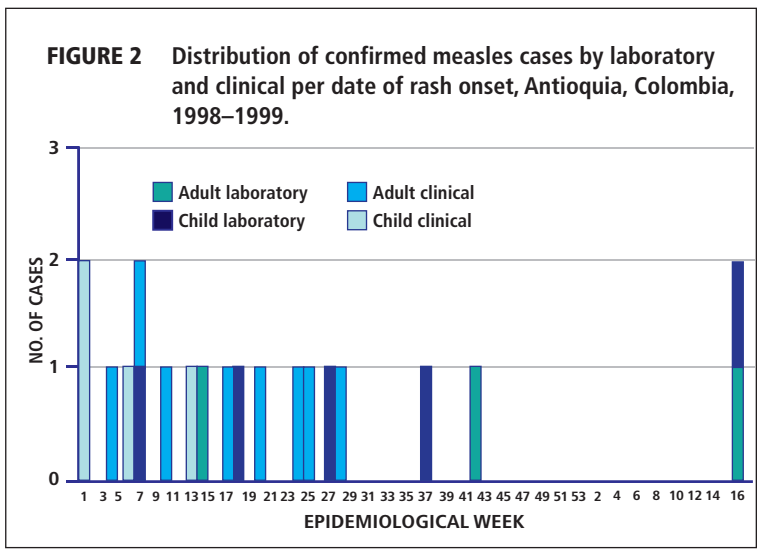
In these two departments, coverage rates with measles vaccine in routine programs for children under 24 months of age had been consistently above 79% for the years 1998-1999. Overall national data for Colombia for 1997, 1998, and 1999 showed coverage with measles vaccine of 88%, 87%, and 79%, respectively for children under 24 months of age. Colombia carried out a national measles follow-up campaign in 1999. In Bogota, data showed that 98% of the children between 1-5 years had received a dose of measles vaccine. In Antoquia, coverage rates reached for the same age group were 74%.

An analysis of the distribution of confirmed measles cases only (Figure 1) by month in Antoquia (population of 5.3 million) for 1998 and 1999, showed two possible explanations: 1) In face of relatively high measles vaccine coverage, the measles virus can circulate without producing large outbreaks; and 2) The surveillance system in Antioquia did not have the capability to pick up additional cases that would account for the sporadic measles cases or the possible chains of transmission. A different picture emerged when looking at both laboratory and clinically confirmed cases (Figure 2). It could be concluded that there may have been ongoing measles virus transmission and that the laboratory data did not support the concept of sporadic measles cases.

The working group recommended that an active search be carried out in the 10 largest urban centers in Colombia, to detect measles virus circulation and prevent the occurrence of a large outbreak. These 10 cities come from departments that contain 62% of Colombia's population. These 10 cities, in turn, account for approximately 34.7% of the total population of Colombia. The rationale for selecting only the largest cities for conducting

From 1997 to 1999, Colombia reported 8, 12, and 10 laboratory confirmed measles cases, respectively. Each case was sporadic in both time and location.





an active search was based on the fact that both, in Medellin (Antioquia) and Bogota cases had occurred mainly in the metro areas. If measles virus was circulating in Colombia, it was concluded that it would likely circulate in urban areas, where the high-density population (hence large pools of susceptible persons) would allow the virus to freely re-seed itself.

Methods

Collection of data

An active search was carried out at health centers and other institutions in Colombia:

- Medical centers: Medical records of 1,189 health institutions (IPS – private or public health providers) were reviewed. Health records were checked to find diagnoses compatible with measles (rubella, roseola, acute exantema, scarlet fever).
- Institutions and households: There were 20,362 visits carried out at universities, schools, households, preschools, hotels, prisons and military barracks. During these visits, questions were asked whether people had seen a person that may have had a measles rash within the last 30 days of the date the search was initiated.

The screening definition used for determining if cases should be classified as a measles suspected case, and therefore requiring a complete epidemiological investigation (including collection of blood and/or urine samples) was:

- A person with fever, maculopapular rash with cough and/or coriza and/or conjunctivitis in the last 30 days since the search was initiated or/
- The presumptive diagnosis by a health care worker was measles.

Results

From 2,396,842 possible leads (health records and leads), 2,496 persons were identified as having a rash (2.4/per 1,000). Upon further investigation, 352 (14%) were classified as suspected measles cases. The distribution of the case classifications is shown in Table 1. During the investigation of all 352 cases, an active search was carried out by health workers in the surrounding communities. No additional suspected measles cases were identified.

Three hundred and twenty four (90%) of the 352 cases classified as suspected measles had an adequate blood specimen taken. Health workers were not able to collect a blood samples in 28 cases. Of these 352 cases, 99 cases (28%) were found in their acute phase. However only 43/99 urine specimens were collected in cases that were found within seven days of rash onset. Only two of the blood samples processed were IgM positive in the laboratory. One case was discarded because the person had received a vaccine containing measles within the last 56 days. The second case with a positive IgM had a severe case of scabies and is still being investigated in the laboratory.

Twenty-eight cases (those without adequate blood sample) remained under investigation at the end of the active search. Upon further review of the 28 cases by the working group, an additional 24 cases were discarded based on information from case investigation forms, clinical history, and discussion with team members in charge of the search in each city. The four remaining cases are still under investigation. In three of them, a rubella diagnosis was made but no blood sample was taken. In these three cases, it was decided that further review of each person's clinical history and an interview with the attending physician would assist in determining final classification. Only one case was classified as clinically compatible in the District of Bogota.

None of the blood specimens collected was positive for IgM rubella. However, there were some dengue IgM positive results. None of the urine collected was processed for virus isolation because it came from cases with negative laboratory results.

Discussion

A broad case definition for a measles case was used to increase the sensitivity of the active search and improve the possibility of detecting cases.

The convenience sample method was used in nine of the 10 selected departments for carrying out the active search in the 10 cities. Only in one city was there the use of a statistical sampling methodology to select the health care providers. In every city, efforts were made to ensure that all segments of the population were covered by including visits to educational institutions or reviews of records of health care providers (IPS) in the target areas. In all cases except in the District of Bogota, all high-risk and geographically under served populations were adequately sampled. In Bogota, visits were not made to health care providers or an active search was not conducted in the community in areas with confirmed measles cases in 1997-1999. Only in 2/13 of the boroughs that form Bogota were health care providers targeted for review of health records, to identify possible measles cases. However, an effort was made to include either a large university and/or a high school in these areas. Nevertheless, the working group determined that more should be done at the borough level to reach health care providers or undertake community searches, to ensure effective detection of circulating measles virus. In the city of Cali, an active search for measles cases in high-risk community areas was not carried out because of administrative reasons. The health team of Cali said it would undertake this activity in March 2000.

A review of the completion of case investigation forms from the active search revealed that only 46% were totally filled out. This indicates the need to strengthen supervision.

In countries with low numbers of confirmed measles cases and where health workers are not familiar with measles, a more sensitive case definition should be considered (see case definition above), to enhance the possibilities of detecting measles virus. Using the measles case definition of PAHO ("any case in which a health worker suspects measles"), health workers diagnosed measles in 26 instances (these had been reported as suspected by the routine surveillance system). When a more sensitive case definition was used, an additional 154 cases were identified as "clinically compatible" with a measles infection. Thus, of the 180 suspected measles cases identified through health care providers, 86% of them were detected using a more sensitive case definition. If one takes into account all the suspected measles cases identified through different institutional searches, including in the community, only 26 cases out of 352 cases were actually picked up. This should be considered as an indicator of the actual sensitivity of the current reporting system in detecting potentially suspected measles cases in the community.

Conclusion

Following the results of the active search and surveillance data obtained from Colombia's routine system, the working group concluded that between August-December of 1999, there was no evidence of measles virus circulation in the surveyed cities. It was also concluded that the active search exercise had allowed health workers to evaluate the quality of the national surveillance system for measles in Colombia.

Source: Ministry of Health, Colombia.

February 2000
Volume XXII, Number 1

Southern Cone: Progress Towards Measles Eradication

Managers of national immunizations programs and laboratory staff responsible for measles diagnosis in the Southern Cone, Brazil, and Bolivia met in January to review the current measles situation and discuss the next steps to meet the deadline of measles eradication by the year 2000. The meeting was sponsored by PAHO and included the participation of Argentina, Chile, Paraguay, Uruguay, Bolivia, and Brazil.

Coverage

Provisional data for the countries of the Southern Cone, as well as for Brazil and Bolivia show that those carrying out a measles campaign for children under 5 years of age reported coverage rates between 94% and 100%. Routine vaccination coverage against measles, however, has been under 95%.

Surveillance

During 1999 there were a provisional total of 3,000 confirmed measles cases in the Americas. These cases occurred in 11 countries, of which only four (Bolivia, Brazil, Argentina, and the Dominican Republic) have reported indigenous virus transmission. Bolivia reported 1,442 cases (48% of the total in the Region), Brazil 756 (25%), Argentina 247 (8%), and Dominican Republic 206 (7%). All these countries are currently implementing aggressive plans of action that include: implementation of timely follow-up measles campaigns, active search of measles cases, and the strengthening of surveillance. As a result, the number of cases decreased in the last quarter of the year (see Figure 1). The five countries that kept high measles vaccination coverage (Canada, Chile, the United States, Peru, and Uruguay) were affected by measles importations, which caused limited outbreaks and no endemic circulation afterwards.

The outbreak in Brazil started in 1996 in Santa Catarina and São Paulo (the latter state did not participate in the last scheduled national measles follow-up campaign). The highest incidence of cases was seen in 1997 (53,644 cases), 68 times more than in 1996. In 1998, the total number of confirmed cases went down to 2,930. Of the 756 provisional confirmed cases in 1999, 305 (40%) occurred in the Northeastern region. The state of Pernambuco was the most affected, with 24% of the total cases in the country.

Unlike the 1997 situation in São Paulo, the age group most affected in 1999 was children under 5 years. With the incorporation of 27 additional epidemiologists, hired as part of a special Task Force, and the implementation of an emergency plan, there was a surge in the notification of suspected measles cases to a total of 33,781 cases. Although each state had at least one laboratory for serological diagnosis, only 355 of the 756 confirmed cases were confirmed by laboratory or had an epidemiological link to a suspected case. Overall, measles vaccination coverage in 1999 reached 93%. However, in 59% of the municipalities coverage was under 95%. In order to interrupt measles virus transmission, Brazil has scheduled a follow-up campaign for June 17, 2000 and has also intensified surveillance. The campaign will target children under 5, up to age 15 years of age in some states.

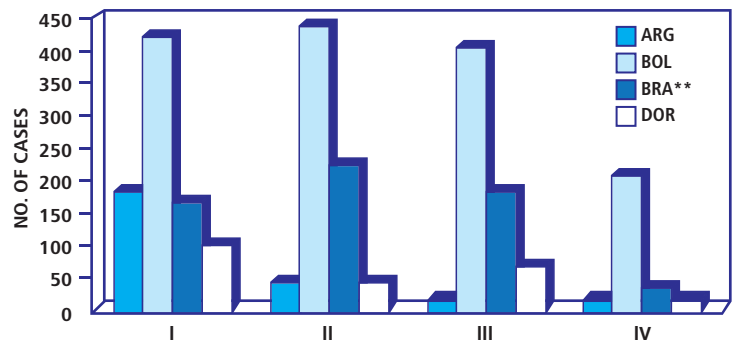
In Argentina, the outbreak began at the end of 1997 in Missions. That year, 121 cases were reported in three provinces. The outbreak spread to the entire country in 1998, with a total of 10,229 confirmed cases. In 1998, a national vaccination campaign was conducted targeting children 1 to 6 years of age, but it did not include all the provinces. During 1999, 247 confirmed measles cases were reported from 12 (50%) of the 24 provinces. The last case was reported during epidemiological week 46 in Mendoza. The population most affected was unvaccinated children under 5 years of age.

TABLE 1. Distribution of suspected measles cases.

Based on serologic sample	No.	Classification				Total		
			No.		No.	Discarded	Under invest.	Clinically confirmed
With sample	324	Discarded IgM (-)			322	322		
		Positivos (IgM)	2	Discarded*	1	1		
				Under inv.	1		1	
Without sample	28	Discarded			24	24		
		Under invest.			3		3	
		Clinically confirmed			1			1
Total	352				352	347	4	1

* Recent vaccination status.

FIGURE 1 Number of confirmed measles cases in priority countries* by quarter, 1999.



* Argentina, Bolivia, Brazil, and Dominican Republic.
** Unknown week of onset for 178 cases.

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In Bolivia, it is important to note that in 1995 vaccination coverage was 80%, but increased in 1996 and 1997 to 98%. Nevertheless, due to lack of vaccines, this coverage declined again in 1998 to 85%. The measles outbreak commenced in May 1998 in Tarija, which borders with Argentina, and from there gradually spread to the rest of the country, with a total of 1,004 confirmed measles cases in 1998 and 1,442 cases in 1999. Fifty-two percent of the total number of confirmed cases in 1999 corresponded to unvaccinated children under 5 years of age.

In order to control the epidemic in Bolivia, the government implemented a plan of action with the collaboration of PAHO, the World Bank, USAID, UNICEF, and the IDB and an important financial contribution from the government. The plan included the implementation of a national followup campaign between November and December 1999. Coverage obtained in the campaign was 98%, with 71% of municipalities reporting coverage of 95% or higher. A dramatic reduction was achieved in the number of cases confirmed since the end of the campaign to date. Currently, the country is carrying out mop-up vaccination and active search of cases in municipalities at risk.

As of March 16, 2000, the total number of confirmed measles cases in Bolivia is 35 (31 by laboratory and 4 by epidemiological link) five are pending and 71 have been discarded. The last confirmed case had onset on February 23. Eighty-six percent (30 cases) correspond to persons over 5 years of age and 62% (22 cases) to those over 15 years of age. Starting from epidemiological week six (February 12), the Department of Beni was the only one reporting confirmed cases due to an outbreak in a military barrack. The departments of Santa Cruz and Beni account for 86% of the cases in Bolivia this year. Other states reporting cases are Pando (3), Potosi (1), and La Paz (1). A total of eight of the 314 municipalities in the country have been affected. In each of the eight municipalities, control activities are being carefully implemented, in order to ensure that transmission is stopped.

Measles Update: Dominican Republic

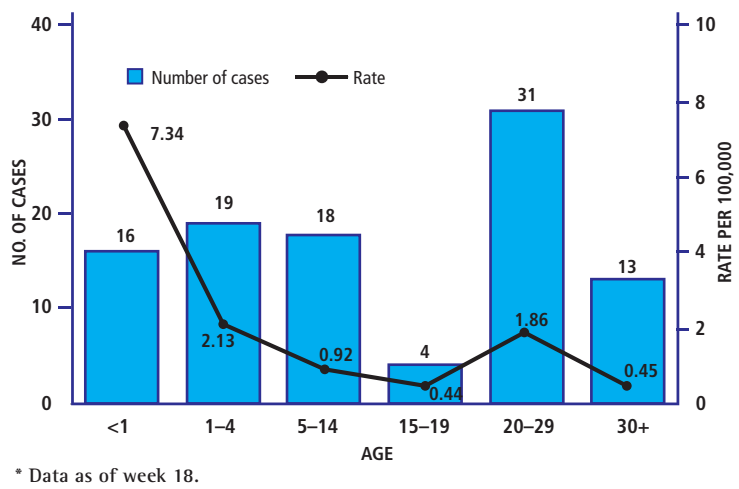
Background

In November 1998, the Dominican Republic was affected by a measles outbreak that began in the province of Altagracia, due to an importation from South America. The same month, the country carried out a follow-up measles campaign that had already been planned, targeting children between 9 months and 4 years of age. Average coverage obtained was 69%, which was insufficient to stop the outbreak. This outbreak spread throughout the country in 1999, with 274 measles confirmed cases reported. Over 50% (14/274) of cases were reported from the Santo Domingo metropolitan area, where pockets of unimmunized children, overcrowding, and low coverage rates from previous follow-up campaigns helped to spread the disease. As the epidemiological data has supported in other outbreaks in the Region, the age group most affected has been children <1 year of age. The age-specific rates for 1999 were: infants under 1 year of age, 18.3 cases/100,000; children 1-4 years of age, 10.2 cases/100,000; children 5-14 years of age 3.2 cases/100,000; and >15 years of age, 1.6 cases/100,000. The age-specific rates for 2000 through epidemiological week 18 are: infants under 1 year of age, 7.3 cases/100,000; children 1–4 years of age, 2.1 cases/100,000; children 5-14 years of age, 0.9 cases/100,000; adolescents 15–19 years of age, 0.4 cases/100,000; young adults 20 – 29 years of age, 1.9 cases/100,000 and > 29 years of age, 0.5 cases/100,000) (Figure 1).

When analyzing the cases by age, 14 of the 16 cases in children under 1 year of age are under 9 months, and 12 cases are between the ages of 6 and 9 months. Furthermore, there has been an increase in the incidence of measles among the 20-29 year age group.

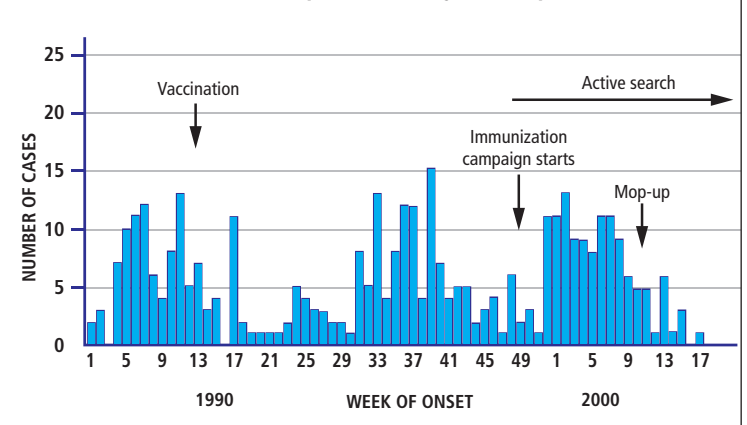
As of May 6, 101 laboratory confirmed measles cases have been reported. During the same time period in 1999, 108 cases were reported (see Figure 2). Over this time period, 1,048 blood samples were taken. Many of these cases were encountered during the active search activities that were conducted in January and February of 2000. The efforts that were made to control this outbreak are described below.

FIGURE 1 Number of confirmed measles cases and attack rates by age group, Dominican Republic, 2000.*



* Data as of week 18.
Source: EPI/Ministry of Health.

FIGURE 2 Confirmed measles cases confirmed by date of onset, Dominican Republic, January 1999–April 2000.



Source: Ministry of Health.
* Data as of week 18.

Vaccination Activities and Active Search

In March of 1999, house-to-house vaccination of children between 6 months and 14 years of age was carried out in the entire country with the objectives of interrupting the outbreak. However, the results were not sufficient to achieve the interruption of measles virus circulation. In order to control the outbreak, an indiscriminate measles campaign was conducted in December, 1999. Nineteen provinces were chosen to participate in the vaccination activities, based upon the following criteria:

- Recent confirmed measles cases
- Low measles vaccine coverage in children <5
- Poor surveillance indicators
- Provinces bordering Haiti
- Urban areas with low income populations and over crowding

All provinces cooperated in the campaign; however, due to the holidays, several areas did not complete their immunization activities and had to resume in January. Overall coverage in children <5 years of age reached 89%.

In order to interrupt transmission of measles, an active search for suspected cases was initiated in January, 2000. Priority was given to "high-risk" areas, such as crowded urban settings with low coverage in the December campaign, bordering provinces with Haiti, and areas where confirmed measles cases were reported in the previous four weeks. Over 20 health professionals were trained in the methodology to conduct an active search with materials developed by PAHO consultants and staff. Each week, teams consisting of two trained individuals and a driver implemented the active search. Components of the active search include: review of public and private hospital records, meetings with the provincial director, epidemiologist and immunization program coordinator, focus groups with leaders and members of the community, and neighborhood house-to-house active search in high-risk areas. As of February, an active search was completed in all of the provinces in the country. This included 95 health centers and hospitals. Here, 225,287 records were reviewed and 385 suspected cases were discovered, from which 320 of serum samples were collected. Of the 385 suspected cases uncovered in the active search, 112 (29%) had already been reported in the surveillance system. This search of cases verified that in spite of all the efforts done, there still remained unvaccinated children and the virus was still circulating in the country. In conjunction with the Provincial Health Directors, the areas that needed further interventions were identified by searching children that had not been vaccinated in previous campaigns.

An important component of PAHO's strategy to eradicate measles transmission involves intensive mop-up activities in areas where the virus is circulating. The Dominican Republic conducted such a campaign from March 10-April 15. Its goals were: 1) to vaccinate 100% of children

Active Municipalities

Active municipalities are those with confirmed measles cases with onset within the last 12 weeks. PAHO is tracking measles transmission in these municipalities on a weekly basis in the Measles Bulletin, http://www.paho.org.

The following is essential in all active municipalities:

- Regular visits (weekly if necessary) to verify the existence of additional cases, through active search and careful investigation of these cases and their contacts. Case investigations must necessarily include a survey of place of residence and/or workplace to determine who has shown symptoms of measles, to collect the necessary blood and urine samples, and to determine in which places the cases have been within: (a) 7-18 days prior to rash onset (source of infection) and (b) between the beginning of the first symptoms (cough, coriza and/or conjunctivitis) until the 4 days following the beginning of rash (places where cases could have infected others). These places should also be investigated.
- Monitor measles vaccination coverage for children 6 months to 4 years of age in two or more blocks defined by the epidemiologist as high-risk (hard-to-reach, and/or with high migrant population, and/or with recent cases).
- If vaccination coverage in a municipality is found to be under 95%, house-to-house vaccination of all children 6 months to 4 years of age should be carried out in the entire municipality.
- If, either through case investigations or because of previous epidemiological knowledge, other risk groups are identified, these groups should also be vaccinated.

between 6 months and 4 years of age who have not been previously vaccinated in all municipalities that have confirmed measles cases (see box on previous page); 2) to vaccinate all children not previously vaccinated between 9 months and 4 years of age in municipalities that have vaccination coverage under 95%; and 3) to vaccinate 100% of children between 1-4 years of age that received measles vaccine before they were one year of age in municipalities that have coverage < 95%. A total of 26 provinces were involved, as well as several neighborhoods in Santo Domingo. House-to-house vaccination took place, using maps and close supervision of vaccination teams.

Vaccine coverage is currently being evaluated by visits to each municipality. The reports from the campaign are being reviewed, as well as monitoring of coverage in high-risk areas.

Source: Zacarias Garib, Linda Venczel, Cristina Pedreira, Jorge Medrano, Katie Alcantara and Escarle Peña.

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Volume XXII, Number 2

Measles in Haiti

Initial Outbreak in the City of Gonaïves

After four years with no reported cases of measles, Haiti detected its first known case of measles on March 15, 2000. This laboratory-confirmed case had rash onset on March 8, 2000 and was detected by the Pediatric Hospital in the city of Gonaïves. That same day, the case was reported to the health department of Gonaïves, which subsequently reported it to the central level on March 22. The case investigation was conducted on March 23 by a team from the Ministry of Health and PAHO.

The City of Gonaïves is located 180 km North of Port-au-Prince on the main road that links the cities of Port-au-Prince, St-Marc and Cape-Haitian, in the department of Artibonite. Approximately 132,786 inhabitants live in Gonaïves, of which 20,501 are children under 5 years of age. During the last national follow-up measles vaccination campaign carried out in November 1999, only 12,482 (61%) of children under 5 years of age were vaccinated against measles in this city.

During the initial investigation, the team found seven cases in the acute phase of the disease. Thirteen additional cases were reported by the Pediatric Hospital, bringing the total to 20 cases. Fifteen blood samples were positive for markers of IgM anti-measles. Urine samples from cases were sent to CAREC for viral isolation.

The index case was a 4-year old child with no history of immunization of a measles-containing vaccine. The child had not traveled nor had he been in contact with persons outside of the city of Gonaïves in the two weeks prior to rash onset. It was difficult to identify the source of the infection for this case.

As of March 1, door-to-door vaccination was carried out, targeting all children (estimated 60,000) between 6 months to 15 years in the entire city of Gonaïves. Ten teams were assembled; each composed of 10 vaccinators and a supervisor. More than 68,000 children were vaccinated in 10 days. This opportunity was also used to distribute supplements of vitamin A to children between 6 months to 7 years of age.

During the recently held evaluation of Haiti's National Immunization Program (March 27 to April 6, 2000), 21 cases were reported to the hospital of Gonaïves. A total of 84 confirmed measles cases have reported through April 30 in Gonaïves. All these cases were children under 10 years of age, distributed in the majority of the city's neighborhoods. None of the cases had a history of vaccination against measles. The highest attack rates were found in children between 3 and 5 years of age.

During the evaluation, visits were made to hospitals in 5 departments and no other suspected cases were detected. However, an active search for suspected measles cases was necessary to determine whether there was measles virus transmission in other areas.

Besides the strategy of door-to-door vaccination, other recommendations included:

- Vaccination of all medical and paramedical staff of health institutions who come in contact with children.
- Vaccination of all children who had contact with the Pediatric Hospital, as well as children who were hospitalized there.
- Vaccination of all drivers and fare collectors of public transportation and children under 10 years of age who travel in buses from Gonaïves towards the other cities of the country.

Active Search and Detection of Cases in Marchand Dessalines

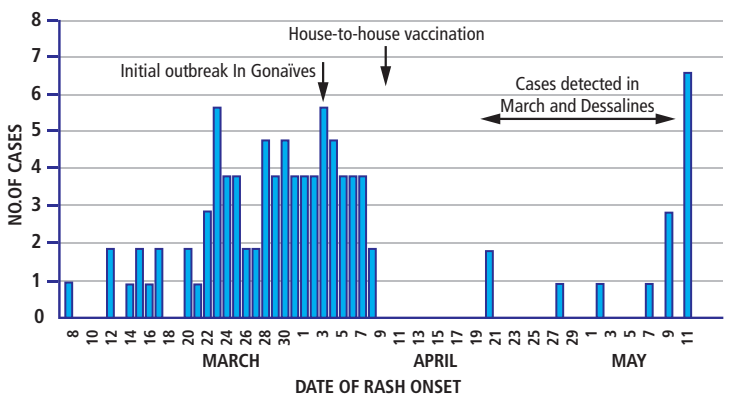
Members of the department of epidemiology, with the assistance of PAHO consultants, are conducting an active search in the major health establishments and the community. Areas include the Department of Artibonite, as well as the Port-au-Prince metropolitan area, and other major cities connected by highway to Gonaïves. Because one laboratory-confirmed case was reported from the City of Marchand Dessalines (a city approximately 40 km from Gonaïves, in the Department of Artibonite), active search activities were directed to this area. An additional 14 cases were later confirmed, of which six were confirmed in the laboratory, and the other eight were epidemiologically linked to these cases (Figure 1). Ages of the cases ranged from 1-14 years of age. House-to-house vaccination was swiftly implemented, with the participation of the team that supervised the immunization activities in Gonaïves. To date no cases have been uncovered in the Port-au-Prince metropolitan area.

The Following Activities are Being Planned to Stop Measles Transmission in Haiti:

- House-to-house vaccination of all children between 9 months and 15 years of age, in the larger urban centers of the country, and of all border cities with the Dominican Republic.
- Strengthening of epidemiological surveillance at all hospitals and others sentinel centers in the rest of the country.
- Visits to all hospitals in Port-au-Prince, in order to quickly detect the circulation of measles virus and presence of possible cases.
- Completion of the active search throughout the country, with complete investigation of all suspected cases within 48 hours.

Source: Salvador García, Fernando Laender, Leyla Peek, and Linda Venczel.

FIGURE 1 Confirmed measles cases by date of rash onset, Haiti, 2000.* N = 99.



* Cases through epidemiological week 18.
Source: Ministry of Health, Haiti.

April 2000
Volume XXII, Number 2

Paraguay Supports Measles Eradication

Between April 24 and 31 May, Paraguay is carrying out a National Immunization Day in support of the measles eradication goal. The campaign is also being used to immunize over 500,000 children under the age of 5 years old with the oral polio vaccine, and to complete the schedules or initiate vaccination with other biologicals. A house-to-house active search for measles cases is also being conducted.

The First Lady of Paraguay, Mrs. Susana Galli de Gonzalez Macchi has been actively involved in the organization of the campaign, as the Honorary President of the National Organizing Committee, which is led by the Minister of Health, Dr. Martin Antonio Chiola. PAHO is providing technical and financial support toward the implementation of the campaign. Other participating agencies include UNICEF, the World Bank, the Inter-American Development Bank, Plan International, the Ministry of Education, the Red Cross, the Armed Forces, Social Security and the Women's Secretariat. Most local governments have contributed with resources.

June 2000
Volume XXII, Number 3

Measles Outbreak in an Isolated Community of Bolivia

Background

In May 2000, the Pan American Health Organization notified the immunization program in Santa Cruz, Bolivia that two laboratory-confirmed measles cases with a recent history of travel to Santa Cruz had been reported in Canada. According to the information received, these cases had rash onsets on May 21 and 28, 2000. They had been in Santa Cruz until May 9. Among the places they visited was a Mennonite community located approximately 200 km east of Santa Cruz in a remote area within the municipality of Pailón. This Mennonite community was established three years ago with settlers coming from a similar community in Canada.

Outbreak Investigation

On June 4, interviews with the leaders of the Mennonite community in Santa Cruz confirmed the visits from Canada on the indicated dates. The investigation team conducted a house-to-house visit of all households (thirty-three families, total population of 229 persons). Of the total population, 45 persons (20%) were less than 5 years of age. During two consecutive visits held on June 4 and 14, a total of 65 suspected measles cases were identified. They occurred in 18 (55%) of the 33 families of the community. Rash onset of the first case was on March 26, and rash onset of the last case occurred on June 13 (Figure 1). Blood samples were obtained in 11 cases for serology studies. All 11 samples were found positive for measles using an indirect capture test at the National Reference Laboratory, and the rest of the cases were confirmed through epidemiological link. To identify the viral genotype, urine samples were obtained from four cases whose rash onset was <7 days prior to the visit. Results from those tests are pending. Of the 65 total confirmed cases, 30 (46%) were under 5 years of age (attack rate of 67%). Prior to the outbreak, vaccination coverage for measles in children 1-4 years of age was 36%.

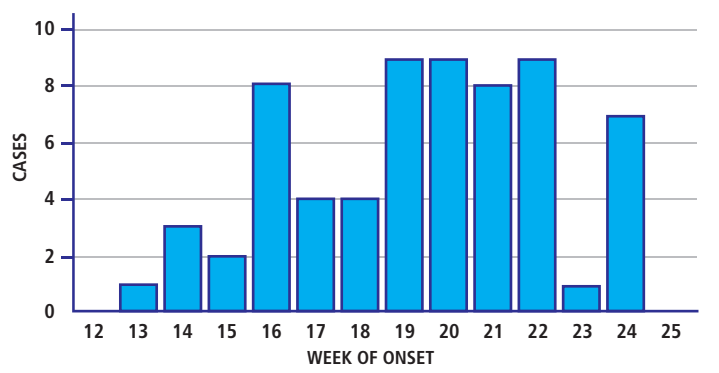
The index case in the Mennonite community of Santa Cruz was a 10-year old girl who had visited her family in the community of Las Piedras II, two weeks prior to rash onset (March 26, 2000). During her stay at her relatives' house, she was in contact with a cousin who had fever and rash. The second case appeared 12 days after (April 4) in a 17-year old adolescent who had visited the sick girl. Following these two incidents, cases started to multiply until the day of the outbreak investigation. During the investigation at Las Piedras II, it was determined that there had been cases of measles during, at least, the first quarter of 2000. The last case was detected on March 28, which occurred in the family that served as a link with the Mennonite community cluster.

Through interviews it was determined that one of the cases of the outbreak, a child from Las Piedras community, had consulted a private physician in February and was even hospitalized, but the case was never reported to the District.

Control Measures Vaccination in Mennonite Communities

Following the detection of the outbreak, a house-to-house vaccination campaign was carried out in two visits. Of the 33 families visited, 3 (9%) expressed philosophical objections to vaccination. After several one-to-one educational meetings with these members of the community (which included the religious leader), they decided to cooperate with the campaign efforts and were vaccinated in the second visit. Rash onset among six of the 65 total cases occurred around six days following vaccination. This can be explained because at the time of vaccination, all these cases had already been in

FIGURE 1 Measles by week of onset, Mennonite community, Santa Cruz, Bolivia, April–May 2000.



Source: Ministry of Health, Bolivia, SEDES/Santa Cruz.

contact with infectious cases for some days, and were therefore incubating the disease. Nonetheless, none of these six cases presented complications.

Interventions in other communities

In view of the outbreak in two Mennonite communities, a vaccination campaign for persons between the ages of 6 months and 30 years of age was carried out in all similar communities in the Department of Santa Cruz. As of July 10, 2000, 15 (38%) of 39 similar communities in Santa Cruz had already been adequately vaccinated (coverage >95%), with coverage confirmed through door-to-door monitoring. Simultaneously, a door-to-door active search for suspected measles cases was carried out in all communities. Also, an active search was carried out in the city of Santa Cruz, particularly in areas of the city that receive frequent visits by members of these communities, and coverage was monitored throughout Santa Cruz as well. Vaccination coverage was over 80% in only two of the 10 blocks monitored in the five districts.

Conclusions

1. Due to low vaccination coverage and the absence of epidemiological surveillance, rural communities such as the one described represent high-risk groups for ongoing measles circulation.
2. A major cause of the outbreak was: a) lack of a vaccination program (routine and during outbreaks); and b) lack of ongoing and systematic outreach and education efforts that highlight the importance of immunization.
3. Deficiencies in surveillance, particularly regarding the participation of the private sector, contributed to the late detection of the outbreak and therefore to its magnitude and duration.
4. Low measles vaccination coverage found in Santa Cruz during the monitoring efforts indicated that the city is at risk of measles reintroduction.
- Nonetheless, no evidence of sustained measles transmission was found in Santa Cruz.

Recommendations

Immediate Actions

- Initiate and maintain outreach and education programs for these communities on immunization and related issues. These activities should be planned and implemented in close collaboration with the community leaders.
- Plan individual visits to these communities to guarantee cooperation for emergency vaccination activities.
- Implement door-to-door vaccination of all similar communities, including all persons aged 6 months to 30 years, until ≥95% vaccination coverage is reached.
- Confirm vaccination coverage reached through door-to-door and school monitoring.
- Implement an active search for suspected measles cases at:
  - all communities during vaccination campaigns
  - all clinics and health centers that serve these communities
- Encourage the participation of private physicians in measles reporting including those already identified as working in these communities. To this end, visit them regularly and strategically place colorful posters with photographs of measles cases and a contact phone number to report suspected measles cases at all physician's offices.
- Prioritize areas at highest risk, carry out door-to-door vaccination of children under 5-years of age in the entire city of Santa Cruz, guaranteeing coverage of at least 95% through daily monitoring and supervision.

Medium-Term Actions

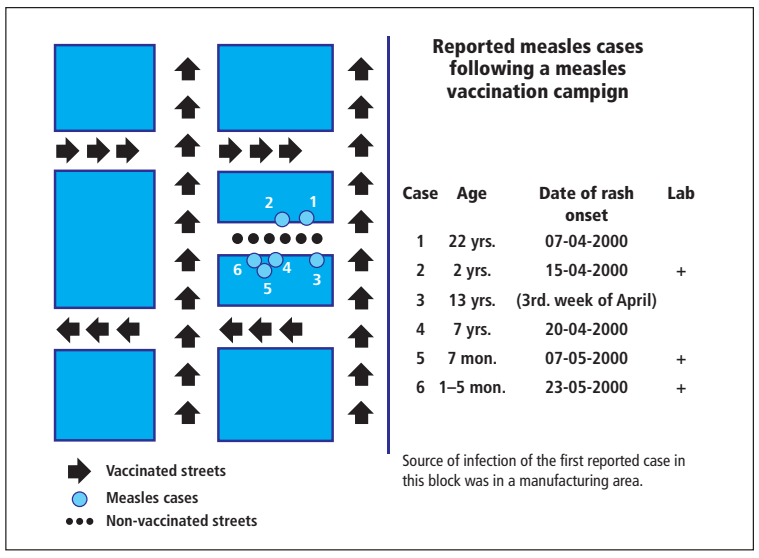
- Maintain regular outreach activities and education programs on immunization, targeting the needs of these communities.
- Train and equip Mennonite vaccinators for all the communities.
- Supervise work of vaccinators at least every two months.
- During supervision, carry out active search of suspected measles cases and monitor vaccination coverage, both house-to-house and at schools.
- Continue visiting all private physicians to encourage reporting.
- Continue house-to-house vaccination in the city of Santa Cruz and at other at-risk areas.

Source: Francisco Giménez S.; Fernando Gil M.; Ana María Barba P.; and Nancy Titichoca V., Ministry of Health, Bolivia.

Editorial Note:
Following the measles outbreaks in both Bolivia and Canada, warnings were sent to all countries in the Region to determine the level of vaccination of similar communities in their territories. Investigations were conducted in Argentina, Paraguay, Brazil, Dominican Republic and Guatemala. No reported measles cases have been found in any of them. Moreover, in most of these countries, particularly the Dominican Republic and countries in Central America, Mennonite communities have been collaborating in ongoing immunization efforts. These experiences indicate that these communities are receptive and supportive of vaccination if approached appropriately.

Because of frequent international contacts, fast growth, dispersion of the dwellings and rural location, these communities can be prone to prolonged epidemics, which can be difficult to detect. Therefore, it is essential that all countries increase efforts to ensure prompt and adequate vaccination and improved disease surveillance.

The Bolivian and Dominican Republic experiences can be replicated in other countries of the Region. It is suggested that health authorities establish local contacts with Mennonite leaders and maintain an ongoing dialogue with them on health issues, which stresses the benefits of immunization. As part of this dialogue, it is recommended that national immunization programs: (1) keep regular outreach and education events on immunization focusing on the needs of these communities (utilizing their own publications, whenever possible); (2) train and equip vaccinators belonging to the community; (3) carry out supervisory visits that have an educational component for these vaccinators at least every two months; and (4) during supervisory visits, monitor vaccination coverage and active search of suspected measles cases.



Editorial Note:
The adequate organization of a vaccination campaign and the ongoing supervision are essential in preventing the recurrence of pockets of non-visited areas that could allow virus transmission to continue. Outbreak response activities should be rapid and well-organized, with one supervisor for each 5-10 vaccinators, daily monitoring of the work by epidemiologists, and effective use of maps of areas to be vaccinated.

HVP staff have been working closely with all countries who currently have ongoing measles virus transmission. Generally speaking, the major obstacles have been inadequate supervision, as well as inadequate procedures for carrying out supervisory activities. Based on the lessons learned from previous vaccination efforts in the Americas, the most important elements include:

Staff Attributes

- Motivated
- Adequately trained (problem solving skills)
- Willingness to walk long distances every day

Methods

- Health workers use chalk to mark house visited and vaccinated.
- Supervisory visits take place to both marked and unmarked houses.
- Supervisors have forms for tallying results of visits.
- Supervisors meet at the end of the day to discuss findings and to improve vaccination tactics.

June 2000
Volume XXII, Number 3

Lessons Learned: Outbreak Response in the Dominican Republic

Health authorities in the Dominican Republic conducted mop-up campaigns from March 10-April 15 in order to interrupt measles transmission in areas where the virus was circulating. By December the country had carried out an indiscriminate measles campaign in 19 provinces. These provinces were chosen based on recent confirmed measles cases, low measles vaccination coverage in children under 5 years of age, poor surveillance indicators, provinces bordering Haiti and urban areas with low income population and overcrowding. The March-April mop-up campaign included a total of 26 provinces, as well as several neighborhoods in Santo Domingo (please refer to the April 2000 issue of the *EPI Newsletter*). This operation was undertaken in Santiago de los Caballeros, the second largest city in the Dominican Republic. As can be seen in the diagram, not all streets were covered for vaccination in an area visited for measles vaccination. During a subsequent outbreak investigation of the same area done in May, six cases were found in exactly the street where vaccination had not taken place. These six unvaccinated cases were eligible for vaccination during the campaign but were not covered.

The March-April mop-up campaign included a total of 26 provinces, as well as several neighborhoods in Santo Domingo.

August 2000
Volume XXII, Number 4

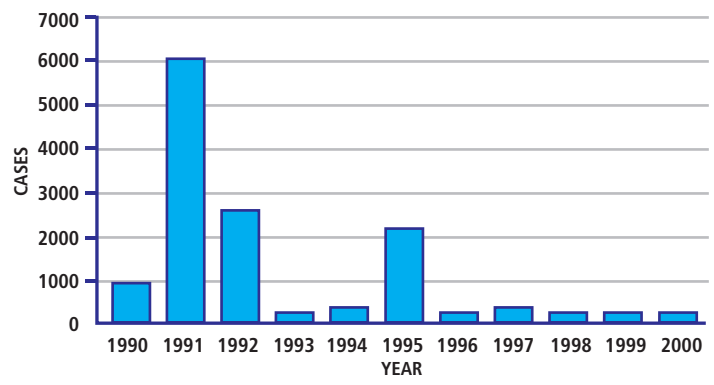
Progress Towards Measles Eradication: Canada

In 1995 Canada introduced an enhanced surveillance system for measles. Subsequently a National Working Group on Measles Eradication was established to oversee measles eradication activities, review cases, and to recommend modification in the prevention and control strategies. Since late 1997, measles is no longer indigenous in Canada, and all confirmed cases reported are either imported or import related (Figure 1).

In 1998, 12 confirmed cases were reported, which is the lowest annual number ever recorded in Canada. In 1999, 29 confirmed cases were reported, 8 of which had exposure outside Canada. There were two outbreaks both linked to virus importation from the Netherlands.

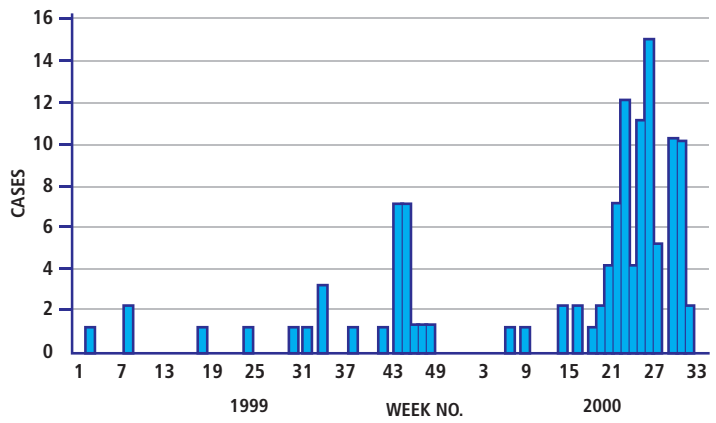
As of August 10, 2000, a total of 84 confirmed cases were reported in Canada from four provinces: Quebec (28), British Columbia (28) Alberta (25), and Ontario (3). With the exception of one case (source unknown), all cases were either imported or import-related. Imported measles cases included two foreign students and six Canadian residents exposed to measles while traveling abroad. There have been four outbreaks associated with travel to or exposure in Mexico and Bolivia, and possibly Belgium, with 6 to 28 cases each, and having up to 4 generations of community-

FIGURE 1 Measles confirmed cases, Canada, 1999–2000.



Source: CIDPC, Health Canada.

FIGURE 2 Measles confirmed cases by week of onset, Canada, 1999–2000.*



* As of August 14, 2000.
Source: CIDPC, Health Canada.

linked spread. All cases were either laboratory-confirmed or epi-linked to a lab-confirmed case. The importation from Bolivia accounted for a total of 44 (52%) of the 84 cases, distributed in two provinces, all among individuals unimmunized for philosophical/religious reasons. Transmission occurred in household and social gatherings, and virologic evidence of importation was found in all outbreaks. In each chain, the viral genotype identified was consistent with the genotype of virus known to be circulating in the source country of the imported case, except for the cases linked to Mexican travel.

Figure 2 shows the distribution of all cases by week of onset from January 1999- August 2000.

OUTBREAK 1: Alberta (linked to travel to Mexico): a cluster of 6 cases linked to Mexican travel occurred in Alberta between April 8 and May 15, 2000 (weeks 14-20), spanning approximately 6 weeks. The index case was a 14-year-old who visited Mazatlan, a tourist area in Mexico, from March 10 to 24, 2000. The onset of rash was on April 8 (15 days after return to Canada). Cases linked in this cluster included two siblings and a contact of the index case, and two close contacts of the siblings in generation-one. Cases ranged in age from 11 to 21 years; median 16. All cases were unimmunized for philosophic/religious reasons. Despite extensive investigation by the Mexican health authorities with the assistance of PAHO, no measles activity potentially linked to the index case was identified in Mexico. PCR testing on nasopharyngeal and urine specimens at Health Canada Laboratory indicated no genetic similarities with the previously circulating measles strains in South America (D6). The strain appears to be new and characterized as D8 (WHO measles Reference Strain Bank, CDC). Therefore, it can be assumed that the index case may be linked to either undetected measles cases in Mexico or cases involving foreign visitors to the area or transit passengers.

OUTBREAK 2: Alberta (linked to travel to Bolivia): This cluster of 19 cases occurred between May 21 and June 26 (weeks 21 to 26), and spanned five weeks. Ages of these cases ranged from 1 to 23 years; median 3 years. The index cases were unimmunized siblings, aged 2 and 3 years, with rash onsets May 21 and May 25. Both were unrelated to cluster one, but with travel history to Bolivia (returned from Bolivia, May 11th) with their parents. Spread of measles occurred for three generations. It was reported that families of the Alberta community in Canada frequently travel to Bolivia to visit sister Mennonite communities that live in very remote areas of Bolivia.

OUTBREAK 3: British Columbia (linked to outbreak 2, Alberta): This outbreak involving 25 cases occurred between June 24 and August 2, 2000 (weeks 25 to 31), centered around a community in Northern British Columbia. Ages of these cases ranged from 1 to 23 years; median 5.5 years. Cases involved family clusters, and almost all were children unimmunized for philosophic reasons. This outbreak started following social contact of unimmunized families from this area with other unimmunized families from a nearby community in North West Alberta (Outbreak 2). Investigation by the Bolivian Ministry, assisted by PAHO, led to the tracing of source of exposure and identified as 'Alberta Mennonite' communities in the Santa Cruz area. Laboratory investigation of Canadian cases revealed that the virus is genetically similar to the circulating D6 strain in South America.

OUTBREAK 4: Quebec (possibly linked to Belgium): This outbreak involving 28 cases and spreading for four generations occurred between May 8 and June 30 (weeks 19 to 26). It involved several families of Hasidic Jews living in a semi-closed community (population 2500). Ages of cases ranged from 7 months to 33 years; median 5.5 years. The majority (70%) of cases were between 7 months and 12 years of age. Immunization coverage in this community, in general, is very low and there were large families with no immunization at all. The source of the outbreak in Quebec has not been conclusively identified but appears to be linked to cases in Belgium. The initial cases were reported to have contact with cases in Belgium, and students from Belgium used to stay with the members of that community. Genotyping results indicate that it is D6, a strain which is commonly found in Europe and in South America.

Conclusions

1. Measles is no longer indigenous in Canada; almost all cases reported since 1998 were associated with importation, and chains of transmissions, up to four generations have occurred in the current year.

2. Almost all cases reported in the past two years have been among unimmunized individuals belonging to specific closely linked communities who object to immunization for philosophic reasons and/or religious reasons. It is reassuring that measles transmission did not occur outside of these communities where vaccine coverage is high. This is an excellent example of how imported measles virus can result in sustained transmission among close-knit or socially linked communities with low immunization coverage rates.

3. A two-dose strategy has been in place in all jurisdictions across Canada for some time; however, these localized outbreaks remind us of the need for public health and health care providers to identify and share innovative methods of reaching susceptible populations to improve vaccine acceptance.

Source: Dr. Paul Varughese, Dr. Arlene King, Division of Immunization, Centre for Infectious Disease Prevention and Control (CIDPC), and Dr. Graham Tipples, Bureau of Microbiology, Health Canada.

Acknowledgement: Assistance of the Working Group on Measles Elimination, all provincial and territorial public health laboratories and health officials, and Lillian Ross is appreciated.

August 2000
Volume XXII, Number 4

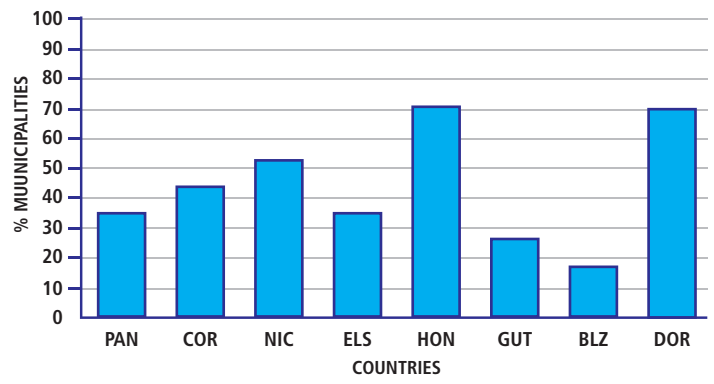
Measles in Central America: Tasks Ahead

Despite two brief reintroductions of measles in Costa Rica in 1997 and 1999, Central America remains free of measles cases. Measles virus circulation in Costa Rica was short-lived, producing small outbreaks that were quickly controlled because of intensive vaccination and surveillance activities.

The absence of measles cases in Central America is the product of major and sustained efforts by health authorities in that Region. Central American nations average vaccination coverage against measles 5-6% higher than the rest of the Americas. However, the region should be cautious and watchful for certain conditions that could lead to measles virus circulation. These include:

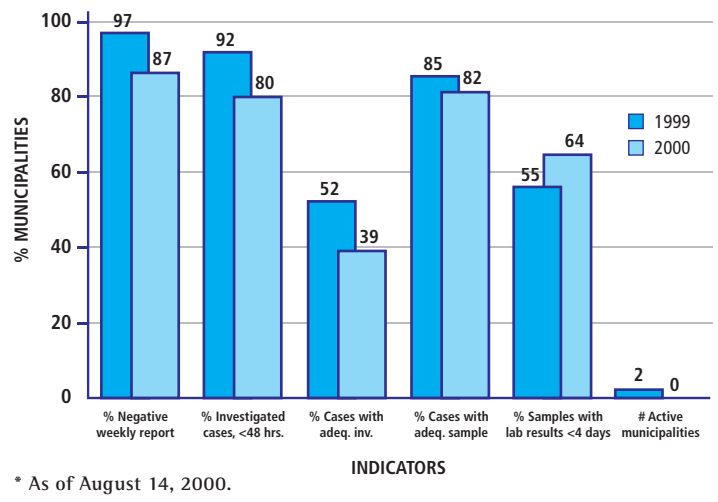
- There still are countries in the Region that have not achieved useful vaccination coverage against measles—that is coverage of at least 95% in children under 1 year of age. This problem is compounded by the fact that the Region has high tourist and migration flows, which constitute great risk factors for potential virus reintroduction, particularly in Guatemala.
- Countries achieving useful vaccination coverage still have a high percentage of municipalities with vaccination coverage under 95%. Approximately 40% of all municipalities in the subregion have useful vaccination coverage (Figure 1). This means that there still are around 700 municipalities of the total of 1,200 that are inadequately vaccinated. Most of these municipalities are found in areas with high tourist flows and steady migration. These circumstances constitute risk factors for potential measles virus reintroduction.
- Approximately 192 municipalities (16%) of the total 1,200 municipalities in Central American countries are located in border areas. Around 5 million people live (15% of the total regional population estimate of 33 million) in these areas. This results in large numbers of potentially mobile and migratory population groups that are difficult to access.
- Some countries that had reached an adequate vaccination coverage are suffering a decline in coverage.
- Some epidemiological surveillance indicators are not being fulfilled appropriately (Figure 2). This carries the potential threat of not being able to detect measles virus circulation in a timely way to contain the spread of measles virus transmission. For example, the percentage of cases investigated in less than 48 hours barely reaches the recommended 80%.

FIGURE 1 Percentage of municipalities with measles vaccination coverage >95%, by country, 1999.



Source: Ministries of Health.

FIGURE 2 Measles surveillance indicators, Central America, 1999–2000.*



* As of August 14, 2000.

Recommendations

- Achieve and maintain vaccination coverage of at least 95% in all municipalities. Priority should be given to municipalities considered to be at highest risk, such as those located in border areas, densely-populated, with high migration, as well as with high tourist traffic.
- Reduce missed opportunities for vaccination to a minimum, guaranteeing the availability of vaccines at all levels of the health system on an ongoing basis.
- Carry out scheduled follow-up measles vaccination campaigns, utilizing the door-to-door vaccination strategy and indiscriminate vaccination of all children under 5 years of age.
- Encourage health authorities to maintain an ongoing dialogue with Mennonite communities in the central region to raise their level of awareness on the benefits of vaccination and the importance of timely reporting of any suspected measles case (or of any other disease under surveillance). This will allow for the prompt implementation of needed control measures. Efforts should also be made in identifying other groups at risk or groups difficult to vaccinate.
- Strengthen epidemiological surveillance for measles, especially in those municipalities considered at risk.
- Carry out social mobilization activities at the community level to foster sustained vaccination efforts against measles and call upon all social sectors to support the regional goal of measles eradication.

Source: Salvador Garcia, HVP/PAHO Epidemiologist for Central America.

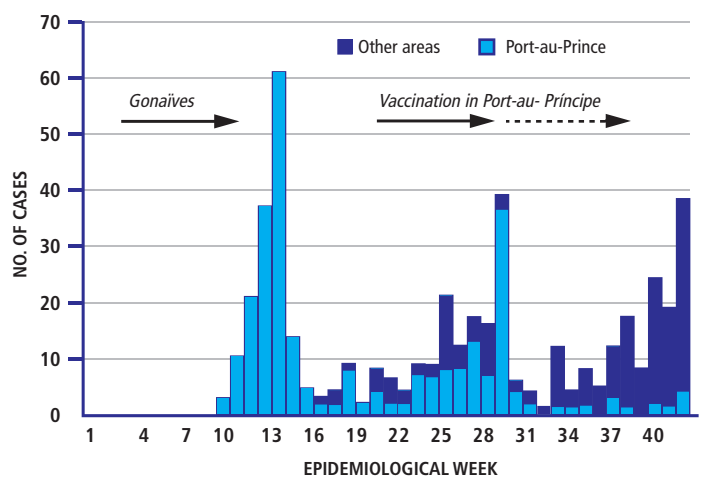
Editorial Note:
In order to stop the outbreak, indiscriminate vaccination of all children regardless of prior vaccination status in high risk areas (areas with recently confirmed cases, or low coverage demonstrated in house to house monitoring) has been planned for the Port-au-Prince area. Increasing the quality of the vaccine campaign within these target areas through careful training of supervisors, vaccinators and coordinators is essential to guarantee >95% coverage.

PAHO recommends that the following steps be taken to assure high quality vaccination:

- Training of all vaccinators, primary and secondary supervisors and area coordinators that includes half a day reviewing forms, marking of houses, biosecurity, and technique, followed by two full days in the field vaccinating, monitoring coverage, and correcting mistakes.
- Maintaining a ratio of one primary supervisor for every five vaccinators, one secondary supervisor for every three to four primary supervisors, and one coordinator for every municipality.
- The main purpose of each supervisory level is to validate coverage through daily monitoring, only shifting vaccinators to other areas when ≥95% coverage has been achieved, and ensuring a continuous supply of biologicals and other necessary materials.
- Improved social mobilization at both the national and local levels, increased active surveillance for new cases, and timely and complete investigation of suspected cases will also be essential components in controlling this outbreak. In addition to increased participation by PAHO and other international agencies, more national personnel are to be assigned exclusively to the campaign.
- The highest national priority is to complete vaccination of at least 95% of the children in Port-au-Prince, where almost one-third of the target population resides and where almost all new cases of measles have been located. Full implementation of these strategies should result in the elimination of measles transmission in Haiti.

immunization remained low. Consequently, there was an accumulation of over 1 million susceptible children below age 5, and Haiti was therefore at risk for a new measles epidemic. A follow- up campaign was conducted in 1999, but the campaign did not reach the majority of children in the target population.

FIGURE 1 Confirmed measles cases by week of onset, Haiti.



Source: MInistry of Health, Haiti.
(onset dates through Otober 2000).

October 2000
Volume XXII, Number 5

Update: Measles Outbreak in Haiti

In 1994, Haiti completed a nationwide catch-up vaccination campaign against measles resulting in an estimated level of vaccine coverage of over 95% of children age 9 months to 14 years. Following this campaign, Haiti remained free of measles for 6 years, but during these years the level of routine

The Outbreak

On March 8, 2000 an epidemic began in the provincial city of Gonaïves in the department of Artibonite. From there the epidemic spread to 22 of the 133 communes in Haiti, including the five communes that comprise the metropolitan area of the capital, Port-au-Prince. By October 28, 2000, passive surveillance had reported 596 suspected cases; 467 of these have been confirmed as measles (454 laboratory confirmed, and 13 clinically confirmed). A total of 10 communes (8%) have reported cases in the last 4 weeks, while 14 (11%) have reported cases in the last 12 weeks.

The outbreak is now focused in Port-au-Prince, where 82 (92%) of the 89 confirmed cases that have been reported nationally in the past four weeks are located. The age-specific attack rates have been highest for children age 1 to 4 years (31 per 100,000), and for infants age 6 to 12 months (29). Rates for these age groups are more than twice as high as that for children age 5 to 9 years (13), an age group that was covered in the previous catch-up campaign. The attack rate for children age 10-14 was 3 per 100,000. Of the 196 confirmed measles cases in Port-au-Prince, vaccine status was reported for 81 (31%), of which 21 (25%) reported having previously received measles vaccine.

Early response to the outbreak

A door-to-door campaign of measles vaccination for all children age 6 months to 14 years was initiated in Gonaïves on April 2 and completed by April 24 with coverage reported to be greater than 95%. Other cities in the Artibonite department also carried out similar vaccination campaigns using the same house-to-house strategy. Within 2 weeks of these campaigns, the epidemic there ended. In spite of active case searches in the larger cities in Artibonite, no further cases have been reported since August 18, 2000.

In the metropolitan area of Port-au-Prince, however, the measles vaccine campaign has taken place over a longer time

period. The campaign began in late May, with the vaccination of children in schools, and continued through July with door-to-door vaccination. After an interruption in vaccination activities due to administrative barriers, vaccination began again in all four communes in late August, and by early September the campaign had moved through all areas of the city but had reached only approximately 82% of the target population of 1.2 million children. Cases have continued to be reported from all 5 communes of the city in September and October, especially from localities with low vaccine coverage.

Source: Fernando Laender, James Dobbins, Jean André, Salvador Garcia, Arthur Marx, Linda Venczel.

October 2000
Volume XXII, Number 5

Measles Outbreak in Venezuela

Four measles outbreaks have been identified in the south eastern part of Venezuela, bordering the region of La Guajira in Colombia. As of November 2, the total number of confirmed cases is 17. Of these, 16 have been laboratory confirmed and one through epidemiological link. So far, ongoing active search of cases, both in Venezuela and in nearby cities in Colombia have been unsuccessful to identify the sources of infection.

The following are preliminary summary reports on these outbreaks. No epidemiological links between the four outbreaks have been identified so far.

City of Maracaibo

OUTBREAK 1: Six cases were reported in the same family of the Cacique Mara parish, with ages ranging from 10 months and 2 years. All except one were unvaccinated. These children spent most of the day in their grandmother's house. One case, however, lives in the parish of Raul Leoni, but has frequent contact with the others. The last case had rash onset October 9, and the first three cases had rash onset September 14 and 15, suggesting a common source of infection for the three. An index case has not been identified yet.

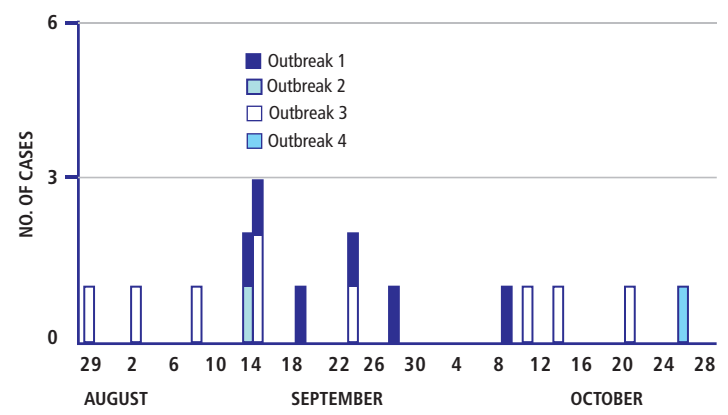
OUTBREAK 2: Only one case has been reported in a 10-month old, unvaccinated child who lives in the parish of Manuel Dagnino. The patient had rash onset on September 13. An index case has not been identified either.

- Mara locality (La Sierrita parish, approximately 40 km to the west of Maracaibo, in the proximity of region of La Guajira in Colombia)

OUTBREAK 3: Nine cases between 11 months and 21 years have been reported in a family and their contacts. Six of them had never been vaccinated, two were vaccinated, and the vaccination status of another is unknown. The last case had rash onset October 14, and the first two had rash onset August 29 and September 3, respectively. An index case has not been identified.

OUTBREAK 4: Only 1 case has been reported in a two-year old, vaccinated child whose mother owns a shop. Rash onset was October 26. An index case has not been identified.

FIGURE 1 Measles by date of onset, Venezuela, August–October 2000.



Source: Country Reports, updated to Nov. 2, 2000. Outbreaks numbered according to month of notification.

October 2000
Volume XXII, Number 5

XIV Technical Advisory Group Meeting

The fourteenth Technical Advisory Group Meeting on Vaccine-Preventable Diseases (TAG) was held in Foz do Iguacu, Brasil

on October 2-5, 2000. TAG meets every year and functions as the principal forum to promote regional initiatives aimed at controlling and eradicating vaccine-preventable diseases. The following are the TAG's conclusions and recommendations as presented in the Final Report.

Measles Eradication

PAHO's Technical Advisory Group on Vaccine Preventable Diseases commended the efforts of countries in the Americas to significantly reduce the burden of measles in the Region. Most countries have already interrupted measles virus transmission as a result of the full utilization of the vaccination strategy recommended by PAHO. The number of confirmed measles cases is at an all-time low and measles is currently affecting only 53 out of approximately 12,000 municipalities. TAG also noted the progress being made at the global level towards accelerated measles control. These efforts will complement and facilitate the work being carried out by all countries in the Americas.

Haiti and the Dominican Republic deserve special attention. Despite repeated vaccination efforts, both countries have been unable to stop measles transmission. Problems have included: failure to implement the full measles eradication strategy, deficient supervision of vaccination campaigns, inadequate and delayed monitoring of vaccination coverage and severe logistical obstacles. As a result many municipalities have failed to reach ≥95% coverage with measles vaccine, thereby leaving pockets of susceptible populations. Attack rates are highest among children <5 years of age. Most cases have occurred among unvaccinated children living in areas already covered by vaccination with a reported ≥95% coverage. House-to-house monitoring of vaccinated areas that lacked adequate supervision revealed insufficient coverage.

Recommendations

Vaccination Strategies

1. Following the successful implementation of a one-time nationwide vaccination campaign of all children ages 1–14 years (catch-up), TAG reaffirmed the other components of the strategy to achieve, maintain and monitor the interruption of endemic measles transmission in the Region: (a) routine immunization of children 1 year of age (keep-up), and (b) a complementary vaccination campaign targeting all children ages 1-4 years, irrespective of prior vaccination history at least every four years (follow-up).
2. It is necessary to achieve and verify a ≥95 percent coverage with measles-containing vaccines in all municipalities:

- Routine vaccination coverage should be validated periodically either by house-to-house monitoring or by the comparison with the number of doses of DTP1 or BCG administered. The regularity of this monitoring activity is critical in densely populated areas.
- Supplemental vaccination (mop-up) activities should be conducted in municipalities failing to reach 95% vaccination coverage. These activities should include door-to-door vaccination.
- Countries should ensure that all campaigns are properly planned and have adequate supervision.
- Vaccination coverage during all outreach efforts should be monitored through house-to-house visits.

3. Ensure the collaboration, implementation and regular monitoring of school-entry laws requiring mandatory vaccination of children entering preschools and schools.
4. In all countries, measles and rubella-containing vaccines (MMR or MR) should be used for routine infant vaccination. In countries with rubella/CRS control programs, measles and rubella-containing vaccines should be used for follow-up campaigns and outbreak response activities.
5. Countries should carry out periodic evaluations of the national immunization and surveillance programs using the PAHO recommended methodology.

Vaccine Availability

PAHO should assure that an adequate quantity of measles containing vaccine (MMR/MR) is readily available to deal with emergency situations, particularly at this time of increasing demands for vaccines in the world market.

Surveillance and Outbreak Investigation

1. A reliable routine surveillance system and its regular validation through active search for cases should be in place, particularly in high-risk areas. Every opportunity should be taken to find cases, including during house-to-house vaccination, routine visits by health center staff, schools, and by special epidemiological reviews.
2. Countries should integrate measles and rubella surveillance.
3. Adequate investigation of all outbreaks should be performed. This includes the rapid investigation of all cases and contacts, identification of the source of cases including epidemiological links, risk factors, and the timely collection and analysis of specimens.
4. Greater collaboration is required between laboratory and epidemiology units in all countries to assure that:

- Serum samples are obtained at the first contact with the patient. In an outbreak, once measles has been confirmed, it is not necessary to routinely collect additional blood specimens.
- Appropriate clinical specimens (urine or nasopharyngeal) for viral isolation should be obtained from every chain of measles transmission, and forwarded to a reference laboratory capable of performing measles virus isolation, and if necessary to determine the viral genotypes.

5. Countries must ensure that all pending measles cases have a final classification within 30 days.
6. All countries should provide data on a weekly basis to the region-wide measles eradication surveillance system, to monitor progress toward the achievement of measles eradication.

Criteria for Interruption of Indigenous Measles Transmission

The principal method for assuring that indigenous transmission of measles has been interrupted is to demonstrate that the virus no longer circulates within a country that has a sensitive surveillance system and documented high immunization coverage. Virologic surveillance with genotype determination should be in place. Also, if measles is introduced, transmission should be limited by rapid and appropriate control activities.

Major Issues

National coverage levels and/or inflated coverage estimates have led to a false sense of security in many countries

Measles vaccination coverage rates in many municipalities, estimated through house-to-house monitoring or other measurement methods, are often substantially lower than those officially reported rates. In addition, some countries rely only on national coverage levels, thus failing to identify local problem areas with low coverage.

Densely populated urban centers pose special problems because they are ideal for prolonged measles transmission due to the rapid accumulation of susceptible children and migrant workers (particularly those of rural origin). Special attention is needed to address these population groups.

Problems in epidemiological investigation of measles cases

In some countries case investigations are poorly performed, thus failing to provide critical information regarding outbreak source and delaying outbreak response efforts. Follow-up investigations, which include the identification of additional related cases, are often lacking. Prompt cross-notification between local jurisdictions and between countries is not carried out on a regular basis.

Special groups at risk of acquiring and transmitting measles

Experience shows that certain groups may be at high risk of acquiring and/or transmitting the disease during outbreaks. These may include: health care workers, military personnel, persons with philosophical objections to vaccination, teachers, university students, workers in the tourist industry, persons living/working within institutions such as prisons, large factories, as well as other young adults of rural origin. Whenever these groups are identified as at risk, they should be targeted for special vaccination programs.

Quality of Surveillance

Measles surveillance needs to be strengthened in many countries to ensure that measles transmission is interrupted. Countries must take specific corrective actions whenever indicators are not at adequate levels.

October 2000
Volume XXII, Number 5

Global Measles Efforts

In view of the significant disease burden of measles (30% of the estimated 3 million global deaths due to vaccine-preventable diseases every year), TAG recommended that the Global Alliance for Vaccines and Immunization (GAVI) supports accelerated global measles control through explicit commitment and financial resources. The following is a report presented by the Department of Vaccines and Biologicals of the World Health Organization.

Measles remains the leading cause of childhood vaccine-preventable deaths worldwide. Although national immunization programs prevent over 80 million measles cases and 4.5 million deaths annually, it is estimated that over 30 million cases and 880,000 deaths still occur every year. This represents 40% of the estimated annual 2 million deaths due to childhood vaccine-preventable diseases.

The disease accounts for 10% of all causes of mortality among children under five years of age.

In May 1989, the forty-second World Health Assembly established a global measles control goal. In 1990 at the World Summit for Children, world leaders endorsed a goal of a reduction by 95% in measles deaths and reduction by 90% of measles cases compared to pre-immunization levels by 1995, as a major step to global eradication of measles in the longer run. Regional elimination goals have been set for the American Region by 2000, the European Region by 2007, and the Eastern Mediterranean Region by 2010.

Extraordinary progress toward measles control has been made since 1989. Measles transmission has been interrupted in most countries in the Americas. Worldwide in 1998, the estimated number of cases and deaths had declined by 63% and 83%, respectively when compared with the pre-vaccine era estimate.

Between 1990 and 1998, global routine vaccination coverage among children aged one year with one dose of measles vaccine remained at between 70 and 80%. In 1998, 15 countries reported measles coverage at below 50%. Ten of those were in the African Region, and one in the South East Asia Region (Democratic People's Republic of Korea). Failure to deliver at least one dose of measles vaccine to all infants remains the primary reason for the high measles morbidity and mortality.

Five strategies are recommended for measles mortality reduction or measles elimination. These are: (1) strengthening routine immunization, (2) ensuring that all children have a second opportunity for measles vaccination, (3) disease surveillance with integration of epidemiological and laboratory information, (4) vitamin A supplementation through immunization services, where appropriate, and (5) adequate case management for every measles case.

The Global Alliance for Vaccines and Immunization (GAVI) aim to ensure that 80% of developing countries have routine coverage of at least 80% in all districts by 2005, is an essential first step in reducing the burden of measles. However, it is important to note that at 80% coverage the remaining measles disease burden is high. Special efforts should be made to ensure immunization safety and to identify and immunize children who have never received measles vaccine (zero dose children).

Measles surveillance should be strengthened in developed and developing countries to monitor program progress. In vitamin A deficient countries, vitamin A supplements should be provided at the time of vaccination with measles (routine and supplemental). Management of complicated cases includes Vitamin A supplementation and adequate treatment.

December 2000
Volume XXII, Number 6

Spain Renews Support for Measles Eradication

The government of Spain, through its Agency for International Cooperation and Ministry of Health, has renewed its commitment to supporting the goal of measles eradication in the Americas.

Spain's grant in the amount of US$ 292,500 will be used to continue strengthening surveillance activities for vaccine-preventable diseases in the Region, especially for the implementation of an active search for suspected measles cases. Priority of the active search effort is being accorded to high-risk areas, such as over-populated urban centers with low vaccination coverage, hard-to-reach areas, and those with a high number of migrant population. The grant will complement national resources in ensuring the availability of diagnostic kits and other critical laboratory material, which are key for the timely and adequate investigation of suspected measles cases. Resources will also seek to support site visits of health staff to local areas, as well as the timely transport of samples to laboratories. Training will remain a key component under the new grant, especially in the areas of surveillance, the use of information systems in support of epidemiological surveillance functions, the effective planning of vaccination campaigns to maximize resources, and the adequate investigation of all suspected measles cases.

Measles transmission appears to have been interrupted in most countries of the Region. In the year 2000, only 1,500 cases were reported, the lowest number ever to be reported in the Americas. Countries that have implemented the vaccination strategy for measles eradication recommended by PAHO in full have successfully interrupted disease transmission. Examples of successes include Peru, Chile, Costa Rica, Uruguay, Canada, Mexico, and the United States, where they have experienced measles importations in the last two years without resumption of indigenous measles transmission.

December 2000
Volume XXII, Number 6

Advances towards Measles Eradication in Brazil, 1999-2000

Background

In 1992, Brazil adopted the goal of measles eradication by the end of the year 2000, and developed the National Measles Elimination Plan to achieve that goal. As part of this plan, the first national catch-up campaign was implemented, with measles vaccination targeted to all children ages 9 months to 14 years. More than 48 million children were vaccinated, for a coverage of 96%. Of the 4,510 existing municipalities in that year, 68% had a coverage ≥95. The number of reported measles cases declined from 42, 532 in 1991 to 2,396 in 1993.

In 1995, Brazil held the first national measles follow-up campaign among children aged 1-3 years, achieving a coverage of 77%. The following year, after a 4-year period of measles control, Brazil experienced a resurgence of measles, with initial outbreaks in the states of Santa Catarina and São Paulo. In 1997, the outbreak spread throughout the country, with 53,335 confirmed cases and 61 deaths nationwide. The strategies to control the outbreak included:

- Intensification of surveillance.
- Following reporting of suspected cases, vaccination of contacts aged 6 months to 40 years without evidence of prior measles vaccination.
- Vaccination in schools, identifying children through 11 years of age not previously vaccinated for measles.
- A second national follow-up campaign among children ages 6 months to 4 years, which achieved a coverage of 66%.

Current Strategies

Immunization

Since 1985 the measles immunization schedule has consisted in one dose of monovalent measles administered between 9 and 11 months of age. In 1992, a second dose of measles was introduced into the routine schedule, through vaccination with the measles-mumps-rubella (MMR) vaccine beginning at 12 months. MMR was introduced into Brazil between 1992-2000 in a phased manner by states, beginning with the state of São Paulo in 1992. By June 2000, measles-rubella (MR), or MMR were part of the routine childhood vaccination schedule in all Brazilian states.

Beginning in 1999, routine vaccination activities have been intensified, with the objective of achieving ≥95% coverage in each municipality. Vaccination activities have included community-based activities such as house-to-house searches for unvaccinated children, with the assistance of community health workers, identifying unvaccinated children in the community, vaccination in schools, and increased emphasis among public health workers about the need for achieving uniformly high vaccination coverage. By September 2000, 51% of the municipalities of Brazil had achieved a coverage of 95% (Table 1).

On June 17, 2000, the 3rd national follow-up campaign was held in Brazil, with mass vaccination of children aged 9 months to 4 years, and introduction of measles-rubella (MR) vaccine in 9 states. The campaign lasted approximately two weeks. Coverage was 100% for measles among children aged <1 year, and 94% among children aged 1-11 years. Overall, 60% of municipalities had a coverage of ≥95%.

Surveillance

Measles has been a legally notifiable disease since 1968. With the implementation of the Measles Elimination Plan in 1992, immediate reporting was implemented, with the target of investigating all cases within 48 hours. Investigation includes collection of blood samples for detection of measles IgM antibodies, vaccination of contacts in the area, and active case finding for secondary cases.

In 1999, as part of efforts to strengthen surveillance, Brazil implemented the Task Force for Measles Eradication. One surveillance technician was assigned to each of the states to assist the State Secretaries of Health. The objective of the Task Force was to achieve the goal of eradication, with an emphasis on strengthening epidemiologic surveillance, through implementation of the following strategies:

- Effective implementation of weekly negative notification, through which each municipality is required to report weekly on the presence or absence of suspected cases.
- Timely and complete investigation of cases and outbreaks, with rapid implementation of control measures.
- Active case finding.
- Assisting and guiding in immunization efforts, including identification and vaccination of high risk groups.
- Analysis of surveillance data, with feedback to technical and political levels.
- Strengthening partnerships with governmental and nongovernmental institutions.

Measles Epidemiology, 1999-2000

In 1999, the national reporting network included approximately 8,000 reporting units, of which only 50% were reporting weekly. Of 10,007 suspected cases of measles reported during 1999, 890 (8.9%) were confirmed, 378 (42%) by laboratory or epi-link. The 890 confirmed cases were distributed in 24 (89%) of the 27 Federal units (26 states and the Federal District). Overall, 235 (26%) occurred among children aged <1 year, and 437 (49%) among

TABLE 1. Measles vaccine coverage among children aged <1 year and number of municipalities with vaccination coverage ≥95%, Brazil, 1995-2000.

Year	Total municipalities	Vaccine coverage ≥95%		Coverage <1 year	Population <1 year
		Municipalities			
1995	4,982	1,131	37	90%	3,363,340
1996	4,998	1,034	24	80%	3,432,229
1997	5,507	2,485	51	100%	3,161,042
1998	5,507	2,150	39	96%	3,206,080
1999	5,507	2,341	43	98%	3,251,279
2000*	5,507	2,808	51	100%	3,296,663

* Preliminary data through September 2000.
Source: COPNI/CENEPI/FUNASA/MS.

children aged 1-14 years. Cases were concentrated in the Northeastern region of the country, which reported 371 (42%) cases, of which 240 (65%) were reported from the state of Pernambuco. Measles control in Pernambuco was achieved through (Figure 1):

- Intensification of routine vaccination
- Indiscriminate vaccination of children through age 15 years
- Vaccination of high-risk groups (personnel in health care and tourism, and migrant farm workers).

The last case in Pernambuco occurred in December 1999.

In 2000, the reporting network was expanded to 9,213 reporting units, of which 81% are reporting weekly. Of 8,560 suspected measles cases notified through December 30, 37 (0.4%) were confirmed, 33 (89%) by laboratory or epi-link. Four were clinically confirmed. The 37 cases were distributed in 8 states and 23 municipalities, of which only one had a case reported in the last 12 weeks (active municipality). Of the confirmed cases, 16 (43%) occurred among children aged <1 year, and 13 (35%) among children aged 1-14 years. The greatest proportion of cases were reported from Acre (37%), followed by São Paulo (37%). The states of Rio de Janeiro, Parana and Amazonas reported two cases each, while Santa Catarina, Goias, and Mato Grosso do Sul all reported one case each (Figure 1).

The last outbreak of measles occurred in the state of Acre in February, 2000, with a total of 15 reported cases (one of which was a patient residing in the state of Amazonas, but in Acre during the incubation period and hospitalized in Acre). The outbreak affected primarily unvaccinated children: 13 (87%) of case-patients were unvaccinated, and 9 (60%) were aged 1-14 years. Of the remaining cases, 4 (27%) were aged <1 year, and 2 (13%) were aged 15-29 years. The outbreak was controlled through house-to-house vaccination in the affected areas, targeted to persons aged 6 months to 39 years, active case finding in the community, and mobilization of health care professionals for enhanced surveillance and vaccination activities.

Of the 13 cases reported to date from São Paulo, 10 (77%) occurred among children aged ≤1 year, of whom 9 (90%) had received a dose of monovalent measles vaccine within the last month. The remaining 3 confirmed cases were aged 15-26 years.

For all confirmed cases, extensive investigations were conducted in the community. These investigations included active case finding in health centers, schools, and day care centers. Despite these searches, no secondary cases were identified.

Conclusions

Measles virus circulation in Brazil appears to have been interrupted since March 2000. Despite an increase in the sensitivity of the surveillance system, with more complete case investigation, the number of measles cases was reduced by 95% between 1999 and 2000. During the same period, the uniformity of measles vaccine coverage by municipality among children aged <1 year increased from 43% to 51%, and overall coverage in the recent follow-up campaign among children aged 1-14 was 95%. The political commitment of the State and Municipal Health Secretaries has been an important factor in the strengthening of surveillance and immunization activities necessary to successfully interrupt measles transmission in Brazil. In addition, the commitment of the State Surveillance Coordinators, State Immunization Coordinators, State Measles Eradication Task Force Advisors, State Public Health Laboratories, and technical staff of the Municipal Health Services has been critical.

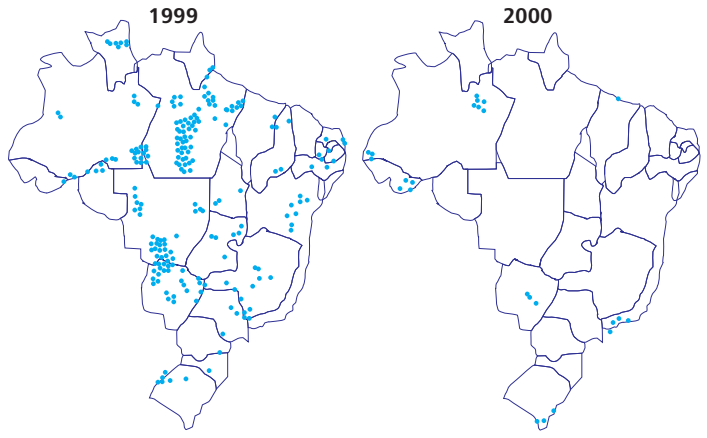
Recommendations

To maintain the interruption of indigenous measles virus circulation in Brazil, sensitive and timely surveillance must continue, and high routine uniform measles coverage must be achieved (≥95% in each municipality). The following recommendations have been disseminated to the Municipal State Health Secretaries throughout Brazil, to ensure effective integration of surveillance, immunization, and laboratory teams for continued interruption of measles transmission:

- Increase awareness among health professionals for immediate notification of suspected cases of measles and rubella.
- Guarantee timely investigation of suspected cases, with vaccination of contacts and collection of blood samples within 48 hours after notification.
- Ensure collection of urine and nasopharyngeal secretions from suspected cases for viral isolation.
- Vaccinate in each municipality at least 95% of children aged <1 year with one dose of measles vaccine.
- Vaccinate at least 95% of children in each municipality aged 12 to 23 months with measles-mumps-rubella (MMR), or measles-rubella (MR) vaccine.
- Guarantee vaccination of high-risk groups.
- Ensure timely and complete data entry into the national information system, for effective use of surveillance data.
- Carry out ongoing analysis, evaluation and feedback of measles and rubella surveillance data.

Source: Maria Salet Parise, Rebecca Prevots, Teresa Cristina Segatto, Maria Carolina Q.C. Perreira, Marcia Mesquita, National Health Foundation, Ministry of Health, Brazil.

FIGURE 1 Measles-confirmed cases by municipality, Brazil, 1999-2000.



* Data as of week 52, 2000.
Source: COVEPI/CENEPI/FUNASA/MS.

2001
April 2001
Volume XXIII, Number 2

Haiti Begins All Out Effort to Halt Measles and OPV-Derived Polio Outbreaks

Background

The Ministry of Health in Haiti is now focused on two fronts: controlling a nationwide measles outbreak and preventing the spread of Sabin type 1-derived poliovirus. Two National Immunization Days (NIDs) using fixed posts and multi antigens were conducted in 2001, targeting both of these problems. In spite of these campaigns, new measles and polio cases continue to be reported, although for measles new cases are being reported at a reduced rate (Figure 1). Future campaigns will rely on house-to-house vaccination with close supervision and careful logistical planning. From May until July, the strategy of rolling campaigns with polio vaccine—staggered vaccination efforts of groups of several departments until vaccination in the entire country is completed—will be implemented.

Measles

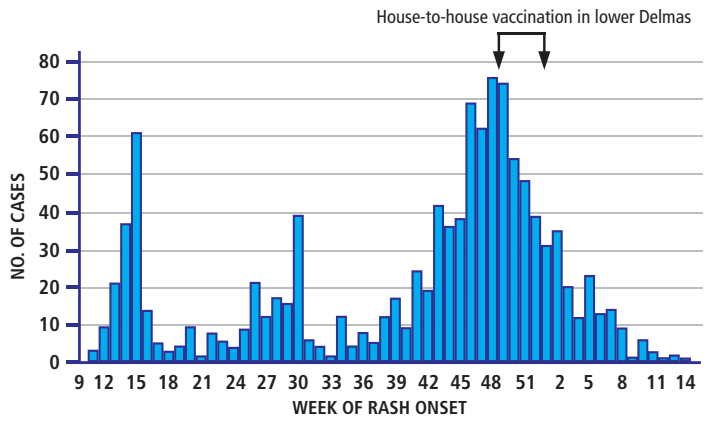
The current measles outbreak began in March of 2000. By mid-April 2001 (the end of epidemiologic week 15), 1,130 cases have been confirmed by the nationwide surveillance system, 990 in 2000 and 140 so far in 2001. Sixty-eight percent of these cases have occurred in the metropolitan area of Port-au-Prince. Since December 2000, there has been a steady decline in the number of confirmed measles cases, dropping from a high of more than 70 cases per week down to the current level of approximately 2-3 per week. With this decline, national and departmental epidemiologists have been able to investigate every case. Two previous National Immunization Days targeting all children from ages 6 months to 14 years for measles failed to reach even half of the population. This was mainly due to inadequate time for planning and implementation of the campaigns, the decision to use fixed posts, and administrative problems. By the end of the year 2000, the Ministry of Health estimated that based on administrative data approximately 70% of the 3.2 million children in Haiti <15 years had been vaccinated for measles, with most of the vaccination activities coming from house-to-house campaigns early in the outbreak. A number of small-scale field studies have confirmed this estimate, finding local vaccination coverage ranging from 50-90%. Mop-up activities will focus on areas with low coverage.

House-to-house measles vaccination will resume in Port-au-Prince and other urban areas once the priority of polio vaccination coverage throughout the country has been completed. Based on the experience in Haiti and other countries, it is now clear that successful house-to-house immunization requires (see shaded box) strong field supervision, revisiting of houses with children that need to be vaccinated, and monitoring of vaccination coverage within each zone.

Editorial Note:

The Ministry of Health of Haiti needs to be commended for its laudable efforts in controlling the ongoing measles and vaccine-derived polio outbreaks in the country. PAHO is confident that the upcoming campaigns, which have been planned in great detail under the leadership of Dr. Henri-Claude Voltaire, Minister of Health, and his team, will be able to successfully halt the spread of these diseases.

FIGURE 1 Evolution of the measles outbreak confirmed cases by month, 2000-2001*



* Data available through epidemiologic week 15 (14 April 2001).

House-to-house Vaccination

This tactic calls for teams of 3 members to be assigned to vaccinate in a neighborhood that is clearly delimited on a map. As the team moves into a new neighborhood for vaccination, each house that is completely vaccinated (or lacking children in the target age group for polio) is clearly marked with a ⊕ in chalk. Houses with eligible children who were absent during the vaccination are marked with a ⊖, meaning that they will have to be revisited. The next day (Day 2), one member of the vaccinating team will revisit the previous day's area, going back to all houses with a ⊖ to vaccinate all children who were missed the previous day, while the rest of the team will go on to the next area. During all days, a supervisor in charge of up to 5 teams will move through the areas to verify that all streets have been visited and marked, as well as confirm that the marks are correct. Also, an overseer will monitor the work of five supervisors, ensure that they cover the areas that were programmed, and monitor house-to-house vaccination status of 20 children <10 years of age in the area. If the vaccination coverage of children is above 90%, then the team can move on to the next neighborhood; if not, further revisiting of houses will be conducted until that vaccine level is reached.

April 2001
Volume XXIII, Number 2

UN Agencies Launch New Plan to Halve Mortality of Measles—A Major Childhood Killer

In a concerted move against one of the world's deadliest childhood diseases, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) today announced a new initiative designed to halve global measles deaths by 2005.

"Measles is still a major childhood killer, with over 30 million cases and nearly 900,000 annual deaths in recent years. These figures are even more shocking given the fact that effective immunization, which includes vaccine and safe injection equipment, costs just US$ 0.26 and has been available for more than 30 years," said Dr. Bjørn Melgaard, Director of Vaccines and Biologicals, WHO.

Measles accounts for the majority of the estimated 1.6 million annual deaths due to childhood vaccine-preventable diseases. Failure to deliver at least one dose of measles vaccine to all infants remains the primary reason for the high incidence and mortality rates of measles.

The Global Measles Strategic Plan calls on countries to assess progress on measles control, identify reasons for low routine coverage, develop a three to five-year plan for measles mortality reduction and fully implement the recommended strategies.

The plan has been developed by UNICEF and WHO in cooperation with the United States Centers for Disease Control and Prevention (CDC), numerous experts worldwide and several other partners. It has the advantage of being a flexible framework that can be adapted to the specific needs and immediate goals of individual countries.

Under the new initiative, WHO and UNICEF will assist affected countries to:

1. Provide a first dose of measles vaccine to all infants.
2. Guarantee a "second opportunity" for vaccination to increase the probability that as many children as possible are immunized and to ensure that those immunized are responding to the vaccination.
3. Establish an effective system to monitor coverage and conduct measles surveillance.
4. Improve management of complicated measles cases, including vitamin A supplementation.

Near blanket coverage is crucial for containing the disease. "Because measles is so contagious and because a small number of those who are vaccinated do not develop immunity, vaccination coverage levels need to be above 90% to stop measles deaths. Unfortunately, this goal has not yet been achieved in all countries," said Dr. Suomi Sakai, UNICEF's Chief of Immunization Activities, "But we know we can get there," she added.

Measles, a viral disease, is spread by infected droplets during sneezing and coughing, through direct contact with nasal or throat secretions of infected persons or by touching contaminated objects. It is predominantly a childhood disease, causing fever and rash and is sometimes complicated by ear infections, pneumonia, or encephalitis (inflammation of the brain) which can result in convulsions, deafness, mental retardation or death.

In addition to the compelling humanitarian and health reasons, the economic arguments for investing in measles control are convincing. Of all health interventions, measles immunization carries the highest health return for the money spent, saving more lives per unit than most other health interventions.

Source: WHO-UNICEF, 29 March, 2001.

June 2001
Volume XXIII, Number 3

Measles Importations in El Salvador

Outbreak description

The following is a preliminary report on the investigations surrounding the importation of two measles cases in El Salvador.

On May 9, 2001, five years after having reported the last indigenous measles case (1996), a private physician notified the Ministry of Health of the presence of two suspected measles cases, two brothers 23 and 22 years old, with disease onset on April 30, 2001, eight days after returning to El Salvador from a trip through Europe.

They had left El Salvador by plane with their parents and an 8-year old brother on April 8 via Houston-Paris (transit) and reached Switzerland where they stayed from 9-14 April. On April 14, they traveled by train to Madrid, Spain, traveling through France, which took them 24 hours. They stayed in Madrid from April 15-21 (7 days), returning by plane to El Salvador via Paris, with a 24-hour layover in Houston. They arrived in El Salvador on April 22.

While in Switzerland, they stayed with family members who confirmed by phone that they did not have or knew of any other similar case. In other countries, they stayed in hotels and did a lot of sight-seeing, yet they stated that they had not been in contact with any other individual presenting rash and fever.

However, during the train ride from Switzerland to Madrid, they remembered a passenger in the sleeping compartment next to them, who was traveling the same itinerary. This passenger seemed to be extremely sick, coughing constantly while in the hallway. However they were not sure whether that person had any sort of rash.

Case notification was made to the El Salvador's National Biological Center on May 9, date when the investigation was initiated. The first case, age 23, had onset of fever on 30 April (8 days after returning from Europe); two days later he presented with a macupapular rash on the face which later extended to the rest of his body, accompanied by cough, conjunctivitis and coryza. He felt general malaise and required hospitalization. At the time of the investigation, the patient had clinically recuperated, presenting with a light desquamation on his face and neck. The second case, age 22, had onset of fever on May 2 (three days after his brother) and four days later presented with a macupapular rash - a similar clinical evolution as his brother. Both cases were admitted to a private hospital from May 7-14.

They denied having any close contact with individuals with similar symptoms, such as family members, neighbors, close friends, and study or work colleagues. Both cases were immunized by their private pediatrician with a single dose of measles vaccine on August 1, 1980. The 8-year old brother was immunized and did not develop any symptoms. The mother and father mentioned they had measles.

Serum samples for IgM determination for measles and urine samples for viral culture were taken on May 9, 2001 in both cases. Both samples tested positive for IgM antibodies to measles by the Behring kit.

During their incubation period, both individuals attended their university (same for both), one of them also works there. The girlfriend of one of the cases was immunized and studies at a different university. The family, as well as both cases went to their places of employment and study, among others. Of these, 20 were singled out because they are well- attended (restaurants, movie theaters, banks, grocery stores, among others). In addition, they were guests at a collective baptism, where 43 children were baptized.

Initial outbreak response

The first control measure of the outbreak was to isolate both cases within the hospital. Hospitalization lasted for 5 days following rash onset, after which time it was considered that the cases were no longer contagious. On the night of May 9, prior to receiving news of laboratory confirmation, the decision was made to vaccinate all health personnel at the hospital where the cases were being treated. On May 10, immediately after the cases were officially confirmed by laboratory, the Ministry of Public Health and Social Assistance (MSPAS) held a press conference announcing the presence of these two measles importations and outlining the control measures that were going to be implemented.

The Ministry of Health carried out the following surveillance and control measures:

- Inter-sectoral coordination between the Institute of Social Security and the private sector.
- Diagnostic confirmation and case management.
- Information campaign

through the mass media.
- Training sessions at the operational level.
- Social participation and mobilization.
- Coordination with the Centers for Disease Control and Prevention (CDC) for determination of the viral genome.
- Daily follow-up of the outbreak situation with the National Technical Committee.
- Regular analysis of the outbreak situation with the Committee for Immunization Practices.

Activities carried out consisted of home visits, telephone contacts every 24 hours and investigation of all suspected cases. As a result of the mop-up immunization carried out at the places visited by both cases (universities, schools, businesses, banks, malls, churches, and place of residence of the cases), 18,618 individuals were vaccinated. The active search for suspected cases carried out by the outbreak control group included the investigation and daily follow-up of direct contacts. The search was extended at the national level and did not find any secondary cases. The maximum incubation period for the contacts during the hospital stay of the cases (7-14 May) terminated on 3 June.

A total of 91 patients were listed thanks to the collaboration of the private hospital and the hospital's physicians. The latter were included in the surveillance activities in an effort to report any suspected measles case. These patients were initially visited and informed about the situation. A daily follow-up by phone of patients was strictly enforced from the date of the first visit until June 3. The search included family members, employees and friends having had contact with them. None of these contacts (patients hospitalized during the same time, attending physicians, and hospital personnel) presented a suspected case of measles, neither did their families, or colleagues.

A study of 83 suspected measles cases reported before the diagnosis of the cases showed that 100% of the samples were IgM negative for measles, 7% (6) were IgM positive for rubella, and 4% (3) were positive for dengue.

Measles situation in the European countries visited

In January 2001, a confirmed case was reported in Barcelona and its source of infection traced back to Bali. Another case was reported in Madrid in April from an individual coming back from Equatorial Guinea. The D7 genotype is not circulating in this country. In Switzerland in 1999 and 2000, 35 and 24 measles cases respectively have been clinically confirmed. It is not known which genotype is circulating in Switzerland.

Analysis of results

- The absence of secondary cases to the imported ones is due in part to the immunity generated by previous outbreaks (last outbreak occurred in 1989), but above all it is the product of the major efforts undertaken by El Salvador to reach coverage rates above 95%.
- The successful measles follow-up campaign carried out during the first quarter of the year, and which achieved a 98% coverage rate was critical in reducing the number of susceptible children.
- The support from health authorities and the work accomplished by the technical teams at the different levels was a determining factor for the management and control of the disease.
- The active participation of the Department of Virology of the Max Bloch Central Laboratory was fundamental for the effective management of the outbreak.
- The information provided by both cases and their family, as well as their active participation, allowed for the implementation of targeted and timely measures.
- The active participation from the community was also key in the achievement of proposed actions.

Conclusions

Based on the epidemiological investigation and the result of the viral genome (D7) study, it can be concluded that the measles outbreak consisted of two imported measles cases which were controlled without any single secondary case.

Recommendations

- Reach, maintain, and guarantee vaccination coverage above 95% in the 262 municipalities of the country.
- Conduct follow-up measles campaigns using the door-to-door immunization strategy and obtain coverage above 95% in each municipality.
- Intensify epidemiological surveillance of measles at the municipal level in San Salvador over the next twelve epidemiological weeks.
- Maintain surveillance for suspected measles cases at the national level.
- Vaccinate risk groups (school teachers and university professors, employees of major manufacturing companies, university students, tourism sector, health personnel, customs officers and airport workers) with measles-rubella vaccine.
- Mobilize the community to participate in immunization activities and the active search of new cases.

Source: Dr. Rolando Hernández, Dr. Carlos Rosales, Dr. Ana Elena Chévez, Ms. Concepción de Orellana, Dr. Genoveva Morales, Dr. Evangelina de Ventura, Dr. Orbelina de Palma, Dr. Julio Armero, Ministry of Health, El Salvador; and Dr. Salvador García, PAHO/WHO.

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Haiti's Ongoing Efforts to Halt the Polio and Measles Outbreaks

After almost a decade with no confirmed cases and declining levels of immunization, both polio and measles returned to Haiti in 2000. To date, there have been 8 confirmed cases of paralytic polio caused by a vaccine-derived virus while for measles there have been 1,148 confirmed cases. Similar epidemics have occurred in the Dominican Republic.

Strategies for the control of these two diseases and lessons learned were major themes of the XV EPI Managers Meeting for Central America, Mexico and the Caribbean held at Port au Prince, Haiti on 12-14 August 2001. Other objectives of the meeting, which was held in Haiti for the first time, examined the quality of disease surveillance in each of the participating countries, reviewed laboratory quality control procedures, as well as the epidemiological situation of rubella and neonatal tetanus.

Vaccination

A national vaccination campaign based almost exclusively on door-to-door vaccination, and a separate 2-week vaccination campaign in kindergartens and primary schools, is designed to deliver measles vaccine to every child between the ages of 6 months and 5 years in Haiti (approximately 1.5 million children), and oral polio vaccine (OPV) to all children under the age 10 (approximately 2.9 million children). It was initiated in mid-September and is scheduled to end by mid-November. A previous polio vaccination campaign carried out in May and June 2001 using the same methodology reached well over 85% of the target population. This level of coverage was confirmed by conducting 659 coverage surveys in those areas where coverage was thought to be the lowest. The methodology for the campaign is based on a carefully-designed plan of door-to-door vaccination that is enhanced by:

- intense supervision in the field;
- the use of two visits to each small geographic sector, the first for general vaccination, and the second, usually on the following day, for vaccination of those children missed during the first visit;
- monitoring of vaccine coverage in a sample of sectors to verify an adequate level of vaccine coverage.

Surveillance

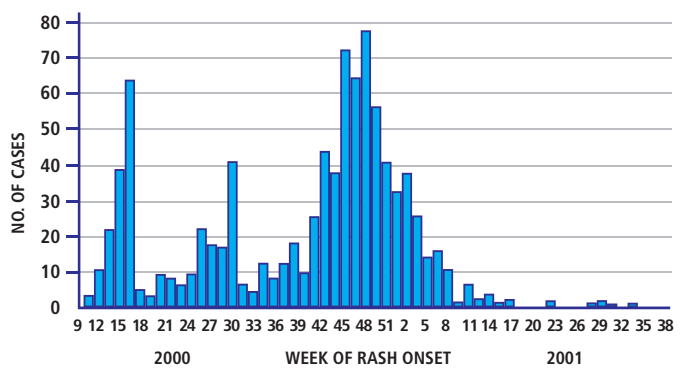
Routine reporting of measles and cases of acute flaccid paralysis (AFP) from all health care facilities in the country is being improved through a collaboration between the Ministry of Public Health and Population (MSPP) and PAHO for training of all health care personnel in the use of

Editorial Note:

Over 70 health workers from Haiti's nine regions joined participants from 10 countries in the XV EPI Managers Meeting for Central America and were able to discuss the results and lessons learned from the vaccination strategies used in previous campaigns. The meeting also provided an opportunity to strengthen the partnership of all actors involved in the efforts to eradicate measles and to prevent further circulation of the Sabin-1 vaccine-derived virus. As seen in Figure 1, great progress has been made. Continued efforts are needed to successfully complete the current vaccination campaign, restart the use of negative reporting in the surveillance system, and continue the active search of cases at all major health facilities. Once the vaccination campaign is completed, mop-up campaigns should be conducted in all areas where new cases are detected by either surveillance or active case search, or where monitoring reveals inadequate coverage. Concurrently, immediate action is needed to enhance Haiti's system of routine immunization in all areas of the country.

Over 120 immunization health staff participated at the XV EPI Managers Meeting in Haiti. From left to right, Mr. Carlos Canseco, Rotary International; Dr. Ciro de Quadros, PAHO; Dr. George Alleyne, PAHO; Dr. Henri-Claude Voltaire, Minister of Health, Haiti; Dr. Lea Guido, PAHO/Haiti; and Dr. Emile Harold Charles, Director General, Ministry of Health, Haiti.; Dr. Emile Harold Charles, Director General, Ministry of Health, Haiti.

FIGURE 1 Evolution of the measles outbreak. Number of confirmed cases, Haiti, 2000-2001*



* Data as of epidemiological week 38 (22 September, 2001).

Recommendations on Polio and Measles from the XV Subregional Meeting

Following a review and discussion of recent information on polio and measles, recommendations for vaccination, monitoring of vaccine coverage, surveillance, and active case search were presented:

- attain a vaccination coverage of at least 90% for 3 doses of OPV; and, for measles, at least 95% in all areas of each country;
- implement door-to-door vaccination as the preferred strategy;
- add measles vaccination in the next vaccination campaign for polio in Haiti;
- monitor vaccination coverage in areas where coverage is suspected to be low;
- conduct follow-up vaccination campaigns in areas where coverage is below recommended levels;
- carry out periodic active case search in all areas with poor surveillance, recent cases, or where coverage is suspected to be low;
- use PAHO investigation methods that include household census, collection of blood specimens and nasopharyngeal or throat swabs for measles, and stool specimens for polio. When cases are identified, carry out investigation within 48 hours;
- include weekly negative reporting from at least 80% of selected health care centers;
- find at least 1 case per 100,000 persons below age 15 for AFP surveillance;
- include private and public health professional in surveillance network.

new surveillance guidelines. Planning is also underway between MSPP and PAHO to identify a group of key health care institutions that will send negative reports weekly to the Ministry. Responsible individuals within each center will be identified and a means of communication with each person will be established. In addition, PAHO has established a US$ 100 reward for the reporting of each case of laboratory-confirmed polio, as well as for the reporting of the first case of laboratory-confirmed measles after completion of the current vaccination campaign. Finally, in the past month presentations have been made to a number of groups, including two Haitian medical societies, Peace Corps volunteers, and the Cuban Medical Brigade, to encourage their participation in surveillance.

Active Case Search

Personnel from MSPP and PAHO have conducted active case searches in all major health care facilities in 8 of the 9 departments of the country. These visits will be continued until the surveillance system is performing adequately. Additional cases of suspected measles and AFP have been found during these searches, and each of these cases has been investigated within 48 hours. MSPP, PAHO, and a task force of collaborating nongovernmental organizations and concerned individuals have made major commitments to the current national vaccination campaign and anticipate that this effort will successfully end the two epidemics.

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Measles Case Classification: Frequent Dilemmas in the Field

The interpretation of a positive-IgM test for measles in countries without known endemic transmission and vaccine-related rash illnesses.

As we approach eradication of measles from the Americas, epidemiologists will be faced with the interpretation of a positive IgM laboratory test in a suspected case of measles in the setting of greatly-reduced disease transmission. Indeed, national authorities will be faced with the dilemma of how to classify an IgM-positive case when no cases have been confirmed in their country for numerous weeks or months. Since no laboratory test is 100% sensitive or specific, laboratory false-positives will occur. Furthermore, the predictive-value positive of a laboratory test decreases as the prevalence decreases. Thus, we should expect false-positive laboratory results to occur. In addition, as countries maintain high levels of vaccination activity, one should anticipate the notification of recently vaccinated persons who present with a febrile rash illness. The dilemma in this situation is to determine if an IgM-positive result is occurring because the individual 1) has a non-measles rash illness and was incidentally vaccinated, 2) has an acute measles infection and was incidentally vaccinated, or 3) has a vaccine-related rash reaction. Here, we discuss the interpretation of an IgM positive test and revisit the definition of a vaccine-related rash.

First, unless there is clear evidence to the contrary as discussed below, all suspected measles cases that are found IgM-positive should be considered laboratory-confirmed cases. However, the finding of isolated measles cases with little or no secondary transmission does not, in any way, imply that a resurgence of endemic measles transmission is occurring in a country with no known transmission. Moreover, in such settings, the finding of isolated measles cases with little or no secondary transmission, as has occurred in Peru, El Salvador, the United States, Canada, and Mexico, suggests that surveillance was sufficiently sensitive to detect the case and that local vaccination coverage levels were sufficient to prevent an outbreak.

a) How should one interpret a positive IgM test in an individual with a febrile rash illness in the setting of no known transmission?

One must assume that it is measles infection until proven otherwise. Since measles is so highly contagious (it has been considered by many as the most contagious infectious disease known), the failure to identify the source of infection or secondary cases, even after a thorough search for cases, does not imply that it is a false-positive laboratory case. It is always possible that the individual was infected by a stranger while on a bus, in town, etc. However, in these exceptional circumstances, the individual can be tested at a reference laboratory for IgG anti-measles antibody. The lack of a significant rise in IgG titers between two properly spaced specimens is sufficiently strong evidence to conclude that the positive-IgM result is a false positive. However, even if tests for IgG antibody levels suggest that a recent measles infection has not occurred for surveillance purposes, an interpretation of a false positive IgM is acceptable only if a thorough active search failed to identify other cases and local coverage (verified by house-to-house monitoring) is sufficiently high, i.e., at least 95%.

b) How do we interpret a positive IgM test in a recently vaccinated individual with a febrile rash illness?

In this situation, it is not possible to determine if the positive IgM is from the vaccination or from a recent measles infection. The case should not be dismissed as vaccine-related based solely on the history of recent vaccination. A thorough case investigation and active search for other cases in health facilities and in the community is warranted as well as a detailed evaluation of coverage. As stated above, the positive-IgM laboratory result could represent either a response to a vaccination in an individual with a non-measles infection, or in an individual with a vaccine-related rash. However, it could also have nothing to do with the individual's recent vaccination but represent a true acute measles infection (i.e., the vaccination was given during the period of incubation and did not prevent an infection). One could test for rubella IgM antibodies, and if positive, the (+) IgM results for rubella and measles could represent a response to a recent MMR or MR vaccination. However, unless the case meets the criteria stated below for a vaccine-related case, in almost all situations the case must be confirmed.

c) In what circumstance can we classify a recently vaccinated suspected measles case as a vaccine-related rash?

One will not be able to conclusively determine if it is vaccine-related, but based on the principles described above, and for surveillance purposes, a case can be discarded and classified as a vaccine-related rash if it meets ALL of the following criteria:

1. Has a rash illness, with or without fever, but does not have cough or other respiratory symptoms related to the rash, and
2. Rash onset began 7-14 days after vaccination with a measles-containing vaccine, and
3. Serum sample, taken between 8 and 56 days after vaccination, is positive for measles, and
4. Thorough field investigation did not identify the index case or any secondary cases, and
5. Field and laboratory investigation failed to identify other causes (including the failure to identify wild measles virus in culture).

Editorial Note:

The definition of what constitutes a vaccine-related rash was discussed during the XIV Meeting of the PAHO Technical Advisory Group on Vaccine Preventable Diseases (TAG) in Foz de Iguazu, October 2-5, 2000 (the final report can be found at: http://www.paho.org; Search: TAG). In addition, a field was created in the MESS database under "Final Diagnosis" for countries to code whether a case's rash and laboratory result were vaccine-related. According to the MESS database in the Regional office, as of week 37 of 2001, 8 countries have reported 27 cases that have been discarded as vaccine-related. Evaluation of these 27 cases reveals that 3 were <1 year of age, 22 were 1 year of age, and 2 were 2 years of age. All had a history of vaccination. However, to be classified as vaccine-related, the interval between vaccination and the onset of the rash must be 7-14 days. Studies suggest that, in general, an interval less or greater than this may not be consistent with a reaction to vaccination. Of the 27 vaccine-related cases in the database, only 13 had intervals of 7-14 days. Four cases have intervals of <7 days and 10 cases have intervals of >14 days.

The four cases with intervals <7 days were from different countries and none had a history of all 3 respiratory symptoms of measles (i.e., cough, coryza and conjunctivitis). However, 3 of the 4 had at least one of the 3 respiratory symptoms. The 10 cases with an interval of >14 days were reported from 7 countries and there was no clustering of cases in any country. Five of the 10 had at least one respiratory symptom. Of these, 2 had two symptoms and one case, with onset of rash 18 days after vaccination, reportedly had conjunctivitis, cough and coryza.

This preliminary analysis suggests that not all countries have implemented the case definition for what constitutes a vaccine-related rash as discussed during the recent TAG meeting. Countries should ensure that cases meet the above criteria prior to classifying it as a vaccine-related rash case. In addition, countries should take this opportunity to review their "vaccine-related" cases and determine whether they truly are consistent with a vaccine reaction. It is acknowledged that by using the criteria described above, a few false-positives or vaccine-related IgM-positive rash illnesses will be confirmed as wild measles cases. In the current phase of the eradication process, this is an acceptable compromise to ensure the highest sensitivity in measles surveillance.

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Improved Surveillance for Polio and Measles in Haiti

Background

Separate epidemics of measles and poliomyelitis have occurred in Haiti during 2000 and 2001. At the end of 2001, major vaccination efforts have reduced the incidence of cases to below the detection level of routine surveillance. The last laboratory-confirmed measles case had rash onset on 26 September 2001, in Carrefour. The national measles immunization campaign (which was also the second national polio campaign) ended November 2001. No additional cases have been found since. For polio, the last laboratory-confirmed case of paralytic poliomyelitis polio caused by a Sabin-1 derived virus was reported July 12, 2001, in Thomazeau, prior to a scheduled vaccination campaign that administered the first additional dose of polio vaccine. The last case of measles was reported by the routine surveillance system. This case was eligible for payment of a reward of U.S. $100 established by PAHO for the reporting of laboratory-confirmed measles cases.

Currently, surveillance must be improved in four areas to confirm that these viruses and the diseases they can cause are absent from the country:

- increase coverage of all health facilities for routine reporting of notifiable diseases;
- establish an enhanced surveillance system comprising of selected health institutions that will file weekly reports when no cases are detected;
- continue systematic active case searches throughout the country;
- continue routine environmental surveys for poliovirus in the metropolitan area and where the most recent cases were detected.

Activities

Routine reporting of notifiable diseases in Haiti is being enhanced by the development of a new information and procedures manual that has been produced by Haiti's Ministry of Health with support from PAHO. This manual will be distributed to workers in all health facilities in the country. The 16 notifiable diseases and conditions in Haiti include polio and measles, as well as other conditions such as neonatal tetanus.

Workshops will be conducted throughout the country to train health care personnel in reporting requirements and procedures that are outlined in the new manual. The first workshops for health staff working at the departmental level were held in November 2001.

In addition to these changes, PAHO continues to sponsor a reward of US$ 100 for the first reporting of cases of either polio and measles in any municipality.

Enhanced surveillance for cases of acute flaccid paralysis (AFP), measles and neonatal tetanus will be established beginning in January 2002. This program will establish a network of 50-100 health facilities nationwide that will send weekly reports by telephone, facsimile, or messenger to the Ministry and PAHO. Most importantly, even in the absence of cases, the health facilities will report weekly (negative reporting).

Neonatal tetanus will be also included in the surveillance system because it is a high-priority disease, and will therefore be used as an indicator of the performance of the surveillance system. Furthermore, PAHO will assist the Ministry of Health in 2002, in strengthening vaccination efforts of women of childbearing age to prevent the occurrence of neonatal tetanus cases. The surveillance system will therefore be able to track the success of this campaign, as well as those for polio and measles.

Active case searches for cases of AFP, measles, and neonatal tetanus will continue to be conducted throughout the country. All major and mid-level health facilities in each department (approximately 100 facilities) will be visited regularly, and all suspected cases will be investigated immediately.

Additionally, each visit will serve as an opportunity to train local health staff on both the importance and method of reporting disease, and to inquire about the functioning of the cold chain and the availability of vaccines.

Environmental sampling will be continued within the metropolitan area of Port au Prince, and in other areas where suspected AFP cases have been identified. Eight sampling points have been established in Port au Prince, two of which have been positive in the past for the derived Sabin-1 virus. Sampling will be conducted every 4 months from these points. Additional samples will be obtained in other zones with confirmed cases of polio attributed to derived Sabin-1 virus, as well as in zones with unconfirmed cases, but for whom it was not possible to obtain stool specimens.

Editorial Note:

The steps outlined by Haiti should confirm the absence of both diseases in the country. Along with enhancing routine immunization and conducting ongoing surveys to find pockets of unvaccinated children, these efforts should ensure that Haiti remains free of polio and measles!

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Measles Case Classification II

Frequent Dilemmas in the Field: Management of IgM-positive suspected cases not felt to be true measles

In the October 2001 edition of the *EPI Newsletter,* a discussion was published centering on the interpretation of a positive IgM test result in the setting of reduced disease transmission. As stated in that publication, for the purposes of measles eradication, all suspected cases that are found IgM-positive should be considered laboratory-confirmed cases until proven otherwise. The article also mentioned that one could test samples for anti-measles IgG antibodies to determine whether a positive IgM represented a false-positive laboratory result. The number of serum samples that are true false-positives should be very few.

However, the process to rule-out suspected false-positive IgM cases requires a standardized methodology to assure proper and consistent classification of cases throughout the region. Furthermore, criteria were presented for classifying an IgM-positive suspected case as having a vaccine-associated rash illness. Here, we continue the discussion on the management of a suspected measles case that is IgM-positive when national authorities are not convinced that it is a true measles infection.

Epidemiologists in the program must be prepared to confront suspected measles cases, without a history of recent vaccination, that are IgM-positive by ELISA when national managers do not believe the case to be measles. This may occur when authorities believe the case is not clinically compatible with measles or, they may consider the laboratory test result to be a cross-reaction, e.g., to a dengue or parvovirus infection. Two questions arise: 1) can the case under discussion be given final classification based on clinical data, i.e., be classified as a discarded case?, and 2) are there additional laboratory testing procedures that can be performed to rule out a false-positive laboratory result?

TABLE 1. Proportion of laboratory-confirmed measles cases and laboratory-discarded cases that fulfill 8 different clinical case definitions, PAHO regional measles database (MESS), 2000.*

Case*** definition	Measles case** % meeting		Non-measles cases** % meeting CD		Risk ratio RR	CI 95%
	YES	NO	YES	NO		
DC #1	62.5	37.5	36.3	63.7	2.8	2.3 3.6
DC #2	63.3	36.7	25.0	75.0	4.9	3.9 6.2
DC #3	52.00	48.0	24.5	75.5	3.2	2.6 4.0
DC #4	51.6	48.4	18.7	81.3	4.4	3.5 5.5
DC #5	62.5	37.5	35.4	64.6	3.0	2.3 3.7
DC #6	63.3	36.7	24.3	75.7	5.1	4.0 6.4
DC #7	52.0	48.0	23.7	76.3	3.4	2.7 4.2
DC #8	51.6	48.4	18.3	81.7	4.5	3.6 5.7

* Data include national notifications of suspected measles cases during year 2000 via the MESS database. A total of 12,524 cases were included in the analysis; 1,039 were laboratory-confirmed measles cases. Cases classified as vaccine-related rash illnesses were excluded from the analysis. Cases without information for a given case definition were excluded from that analysis.

** Measles cases are laboratory-confirmed with a positive IgM, non-measles cases are laboratory-negative for IgM by ELISA.

***Clinical case definitions (CD) are as follows: #1=cough and coryza, #2=cough and conjunctivitis, #3=coryyza and conjunctivitis, #4=cough, coryza and conjunctivitis, #5=cough, coryza and fever, #6=cough, conjunctivitis, fever, #7=coryza, conjunctivitis, fever, #8=coryza, cough, conjunctivitis, fever.

What is the utility of clinical surveillance data in discarding a suspected measles case?

For the purposes of the regional measles eradication program, a suspected case, regardless of their IgM test status, should not be discarded based solely on clinical data, or, more specifically, because of the lack of a clinical presentation considered typical of measles. Measles is generally described as an infection producing fever, rash and respiratory symptoms such as cough, conjunctivitis and coryza. Even so, the lack of these symptoms should not lead one to discount the possibility of an acute measles infection. A mild infection may produce a clinical picture atypical of classical measles.

As shown in Table 1, using national data from the regional MESS database for suspected measles cases with onset of rash in year 2000, laboratory-confirmed measles cases (n=1,039) were more likely than IgM-negative discarded cases (n=11,485) to meet 8 different clinical case definitions, i.e., combinations of clinical symptoms, based on surveillance data. Even so, and importantly, an important proportion of laboratory-confirmed measles cases failed to fulfill the clinical case definitions. For example, while laboratory-confirmed measles cases were over 4 times more likely than discarded cases to have a history of cough, conjunctivitis and coryza, 48% of measles cases did not present with a history of the three symptoms, at least at the time when evaluated by a program staff person. Thus, a program manager should not disregard a laboratory result because of the lack of clinical compatibility.

Even so, when presented with an IgM-positive suspected case that is not believed to be measles, one could intensify a search for an alternative diagnosis, e.g., presence of a vesicular rash implicating a varicella infection. Failure to conclusively establish an alternative diagnosis by laboratory confirmation implies that the case must be confirmed as measles. In addition, the reverse is true, if one considers a case to be clinically compatible with measles but

is IgM-negative, one should attempt to determine if the sample was taken appropriately, if there are other cases in the area, etc.

(b)What laboratory testing procedures can be performed to confirm that an IgM-positive test result represents an acute measles infection?

When confronted with an IgM-positive result that the country feels could be a false-positive and when an exhaustive case investigation fails to identify other cases, including the index case, one can consider further testing at a reference laboratory for IgG anti-measles antibody titer levels (Figure 1).

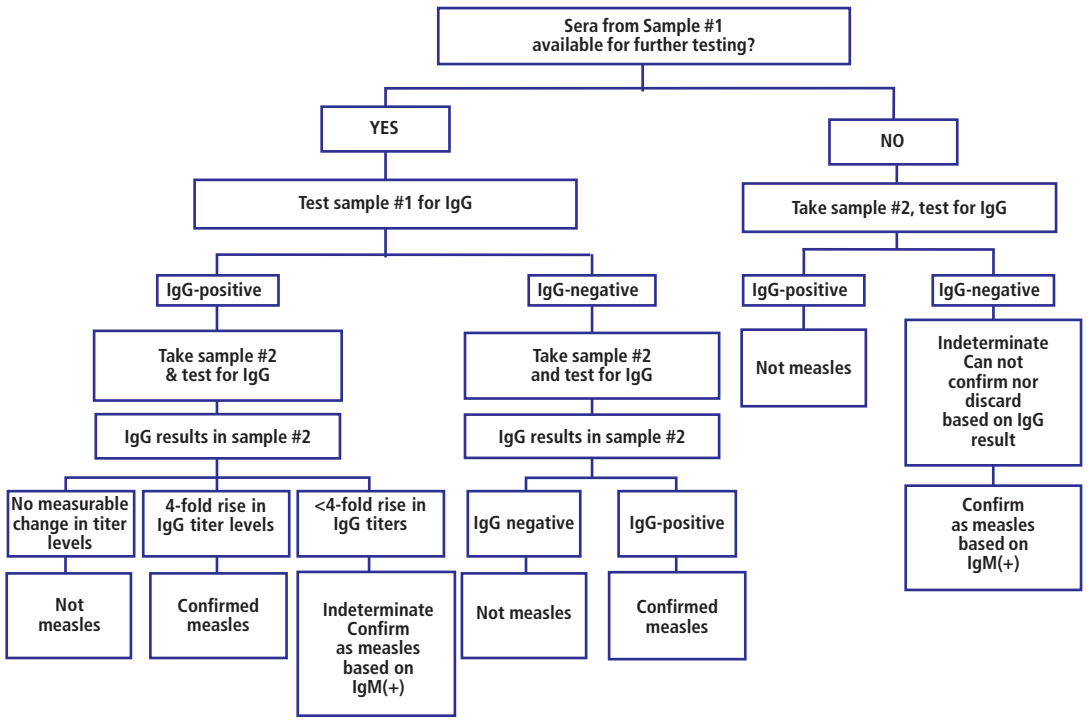
IgG titer levels should be determined in two properly spaced and timed blood specimen in a test that actually measures measles IgG titer levels, e.g., HI, or PRN. To be considered properly spaced specimens, the first specimen should be collected within 7 days of rash onset and the second specimen should be obtained 3 to 4 weeks post rash onset, i.e., 2 to 3 weeks post sample #1.

As seen in Figure 1, if sera from the first sample is found to have IgG antibodies and if the second sample has no change in IgG titer levels as compared to sample #1, it would not be considered a measles case and could be discarded. The IgM-positive test result would be considered a false-positive. However, if the second sample shows a four-fold rise in IgG antibody titer levels as compared to sample #1, it should be considered an acute measles infection and confirmed. If the second sample shows an increase in IgG titer levels but less than a four-fold rise from the first sample, it would not be possible to determine if it were or were not an acute infection. In this situation, the case should be confirmed based on the positive-IgM test result.

If the first sample is negative for IgG antibodies and if the second sample is also negative for IgG antibodies, it would not be considered a measles case and could be discarded. If, however, the second sample is IgG (+) for measles, it would be confirmed as acute measles infection.

The other situation occurs when there is no further sera from sample #1 for IgG antibody testing. In this case a second sample would still need to be collected. If negative for IgG, the case could be discarded. If, however, the second case based on the IgG titers. It would not be possible to determine if the positive-IgG represented an acute or past infection. In this setting, the case must be confirmed based on the IgM test result. Regardless of the scenario or testing sequence results, when in doubt, the case should be confirmed based on the positive-IgM test result.

FIGURE 1 Testing algorithm for suspected measles cases with IgM-positive test results when a false-positive is suspected.



2002

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Measles Outbreak in Venezuela

Summary

Since August 2001, Venezuela is affected by a measles epidemic. A total of 347 cases have been reported since the beginning of the epidemic. During January 2002, 244 confirmed cases have been reported from three states (Figure 1). The state most affected is Zulia, the most populated in the country, bordering Colombia, with 228 confirmed cases in the first four weeks of 2002. Venezuela has become the only country in the Region of the Americas with measles circulation. If not controlled soon, the epidemic can spread to other countries of the sub-region that also have areas where vaccination coverage is low.

Background

Venezuela is a country of 25 million people living in 23 States, plus the Capital District. The last large measles outbreak occurred in 1993 – 1994, during which a total of 38,000 measles cases and 124 deaths were reported. In response to the outbreak, and following PAHO's recommendations, Venezuela carried out a catch-up national measles vaccination campaign targeting children ages 6 months to 14 years, with a 98% reported coverage. This campaign resulted in a dramatic reduction of measles morbidity and mortality - the last death reported due to measles occurred in January 1995. The next follow-up measles vaccination campaign was held in 1998, and used a measles/mumps/rubella (MMR) vaccine. Official coverage reached 92%. Subsequently, during 1998, there were only 4 cases, and none in 1999. Between 1995 and 1997, routine measles vaccine coverage for 1-year olds was below 70%. In 1999, routine coverage was 80% and 84% in 2000.

During 2000, an outbreak of 22 confirmed cases among preschool and school-age children occurred in the municipalities of Maracaibo and Mara, Zulia State. Because of delays in the reporting and investigation of the outbreak, its origin remained unknown. During the first semester of 2001, a nationwide active case finding identified a total of 8 suspected measles cases that had not been previously reported, for which no serum samples were available. Given the lack of sufficient information, these 8 cases were defined as clinically confirmed.

An evaluation conducted by the Ministry of Health and an international team led by PAHO in May 2001, confirmed the country's low routine vaccination coverage and recommended that health authorities carry out as soon as possible another follow-up measles vaccination campaign. The campaign needed to reach 95% coverage with measles-containing vaccine in all municipalities of the country. However, the campaign was delayed, and on September 28, 2001 a measles case was reported in the State of Falcon. Up to September 2001, annual measles vaccination coverage in Falcon, projected to December, was only 44%.

The 2001-2002 Outbreak Falcón

The index case was an adult male aged 39 years with rash onset on August 29, 2001, one day before returning from a trip to Europe. He visited Switzerland, Germany and Spain during August 4-30. The second case of the outbreak, a 35 year-old brother of the index case, with rash onset September 21, 2001, became the first to be reported on 28 September 2001, after three visits to health facilities. Serum samples from this case tested positive for IgM, and an urine sample was taken for viral isolation and is being analyzed at the Centers for Disease Control and Prevention in Atlanta, Georgia.

The outbreak in Falcon lasted until week 50 (15 December), with a total of 35 confirmed cases, mostly unvaccinated persons, distributed in three municipalities (Figure 1). Of the total cases, 16 corresponded to the 1-4 age group (46%), 12 cases to the >20 years age group (34%); and 4 were <1 year (12%). The attack rate was highest among <1 year old (26.7 per 100,000), 1- 4 years (25 per 100,000) and 25-29 years (16.7 per 100,000). The majority of the adults were laborers, school students and health care workers. The outbreak was interrupted after a statewide MR vaccination campaign for children aged until 15 years. In the affected municipalities, the campaign also included adults. During epidemiological week 5, 2002, measles was reintroduced to Falcon. The first detected case was a 7-month old girl, who lives in Zulia and visited the municipality of Carirubana in the peninsula of Paraguana, an important tourist area, and had rash onset on January 3, 2002. The infant was taken to a health center run by the Social Security of Venezuela, where she tested positive for measles. Three cases, a nurse and two others, had contact with the same hospital. This reintroduction had limited spread (9 confirmed cases, none in the last two weeks). Of the 9 confirmed measles cases, two are children <1-year of age and the 7 remaining cases are >24 years of age. It appeared that the 1-14 age group, vaccinated in the November–December campaign, had not been affected.

Zulia

During epidemiological week 43, 2001, the state of Zulia, located West of the state of Falcon, reported a confirmed measles case in the city of Maracaibo, a 27 year old nurse assistant in a private clinic, who had rash onset on October 25, 2001. On the following day, another case was reported, a 1-year old girl, who had been seen by the nurse four days prior to developing rash and fever. The girl was given respiratory therapy due to a suspected pneumonia and had rash onset November 1, 2001. The nurse also infected her 3 year-old son and a 22 year-old sister, as well as a 27 year-old colleague and her 10-month old daughter, who resided in another parish of the municipality of Maracaibo.

Although the source of infection of the primary case at Maracaibo could not be identified, this clinic receives many patients from the State of Falcon who are employees of an oil company from that State.

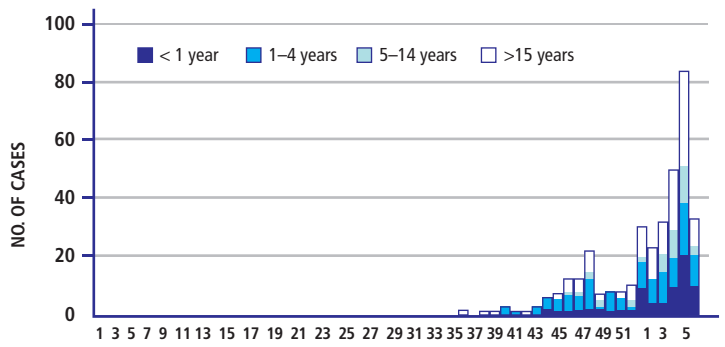
On November 16, three suspected measles cases were reported in the municipality of San Francisco, which together with the municipality of Maracaibo form the city of Maracaibo, a city with the greatest population density in the country. One of the cases is a 27-year old male working as a guard in an ambulatory health center in San Felipe. He travels twice a week to the State of Falcon, especially to the municipality of Buchivacoa. The other two cases correspond to a 4-year old girl, who visited the health center of San Felipe several times, and a 1-year old boy who lives in the same building as the guard. These three cases were confirmed as measles by the regional laboratory. The outbreak spread during November 2001-February 2002 and is ongoing. A total of 223 cases have been reported from Zulia alone, affecting all age groups up to age 34 years (Figure 2). Moreover, a large majority of the cases were previously unvaccinated. As of September 2001, projected routine vaccination coverage with MMR in the state of Zulia was 34%.

The majority of infected adults have been health care workers, employees, laborers, students and housewives.

Trujillo

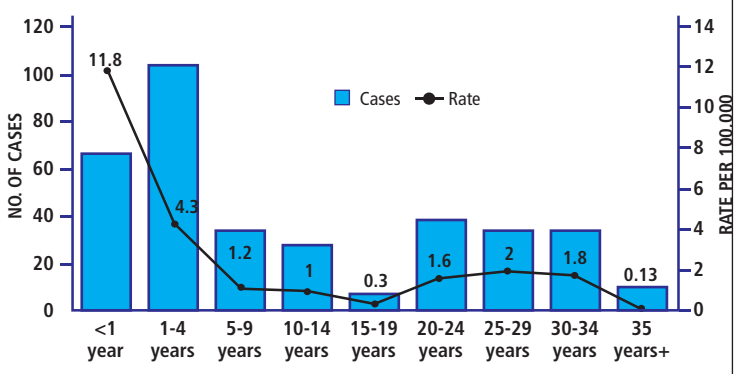
On January 29, 2002, health authorities in the state of Trujillo, South-East of Zulia, investigated suspected measles in a 1-year old child from Maracaibo, Zulia, who was visiting his grandfather. He had received a dose of MR in Maracaibo on January 21, 2002, six days before the rash. An active search for measles cases

FIGURE 1 Distribution of confirmed measles cases by age group and week, Venezuela, 2001–2002.*



* As of epidemiological week 6, 2001.
Source: MOH.

FIGURE 2 Distribution of confirmed measles cases by age group and rate per 100,000, Venezuela, 2001–2002.*



* As of epidemiological week 6, 2001.
Source: MOH.

Editorial Note:

Venezuela is at the moment the only country where transmission is now prevalent. The Ministry of Health of Venezuela and the State Health Authorities are taking the necessary measures to stop the transmission of measles. Following a few years with low or no incidence of the disease, introduction got transmission established in at least two states. This indicates that a high level of coverage and surveillance have to be maintained at all times. Some factors were decisive for the reestablishment of transmission after measles virus was introduced in the country. Among them was low vaccination coverage in several areas, resulting in the accumulation of susceptibles that fueled the introduction and dissemination of the measles virus. Annual coverage in the affected parishes and municipalities of the states of Falcon and Zulia have ranged between 10% and 30%.

Some deficiencies in surveillance also contributed to the current measles situation in Venezuela. The first case was neither detected nor reported on time, even though several public and private hospitals and clinics had seen it. Also, the next few cases were reported late. Problems in reporting caused delays in the intervention, allowing the outbreak to spread to a highly populated state (Zulia), despite the fact that the vaccination measures taken in Falcon had been appropriate and effective. The appropriateness of the intervention in Falcon was shown by the limited secondary spread when measles was reintroduced to Falcon in January.

As has been the case in previous measles outbreaks in the Americas, there was a significant contribution of unvaccinated health care workers to the spreading of the measles virus.

Based on these lessons and the recommendations of the evaluation, the health authorities of the country have recognized the need to make radical changes in the management of the different aspects of the regular program. Steps are being taken to develop an annual Plan of Action for 2002.

was instituted and vaccination of all children <15 years in the entire municipality was strengthened. No further cases had been found as of February 20, 2002.

Control Measures

Nationwide measles vaccination campaign for children ages 1-4 years (follow-up campaign): A national, followup door-to-door measles vaccination campaign was started in November 2001. Preliminary reports of vaccination coverage during the campaign showed 100% coverage in most States. In Zulia, as in most States, reported coverage exceeded 100% in all 21 municipalities, but houseto- house monitoring of vaccination evidenced numerous unvaccinated children. Nationwide, between 80 and 85% of all children visited during house-to-house monitoring (that uses convenience samples) had been vaccinated. Based on these data, vaccination brigades are moppingup parish by parish children that lack proof of vaccination, including now children under 1-year of age, the highest risk group.

Vaccination in Falcon: In the municipality of Zamora, where the first cases occurred, an aggressive door-to-door vaccination effort was carried out that targeted the population from 6 months to 60 years of age. Reported vaccination coverage reached 98%. In the rest of the State, the scheduled follow-up measles vaccination campaign was extended up to age 15 years.

Given that cases had reported frequent contacts with health facilities, vaccination of all health workers at private and public health establishments was required in the municipalities of Zamora and Miranda, and subsequently in the rest of the State, to avoid for them to become a potential foci of virus dissemination. Health authorities have made it imperative for all health workers in private and public health establishments to be immediately vaccinated.

Next Steps

Starting in March, 2002, the Minister of Health and the main health authorities determined the following strategies aimed at ending the circulation of measles virus in Venezuela:

1. Indiscriminate mass vaccination of all children <15 years in the country, and up to 34 years in the risk areas (captive population in barracks, factories and universities, factory and construction workers and army recruits, persons who live in large, peri-urban concentrations of people of rural origin, bus drivers, migrant population that circulate between Colombia and Venezuela).

2. Design and implemention of an aggressive plan of social mobilization of the campaign, led by the Ministry of Health and Social Development, with active participation of the Governors and political authorities in the different states.

3. Preparation and immediate publication of Ministerial Resolutions requiring vaccination of all health care workers that provide services to the community, and of all children <15 years attending educational, private or public establishments, in agreement with the Ministry of Education.

4. Provision of necessary resources for the mobilization of vaccination brigades at the local levels in the different states.

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Regional Measles Database: How "Clean and Complete" are the Data?

As discussed in previous *EPI Newsletter* articles, the "cleaning" of data after entry into any database is crucial. Country managers are encouraged to review the quality of the data entered before sending the weekly data files to PAHO/Washington. In addition, no data fields should be left blank. To estimate both the quantity of potential data entry errors and the completeness of the data in the regional database, an evaluation was conducted of the Measles Eradication Surveillance System database (MESS) in Washington, D.C. for years 2000 and 2001 (as of March 29). The data for both years was extracted into EPI INFO and simple frequencies were tabulated on selected key variables. For each variable, the following was determined: (1) the number of variables that lacked information, (2) the consistency in the use of a "ZZ" when information was not available (as is recommended) versus simply leaving the field blank, and (3) if there were obvious data entry errors, e.g., entering an impossible data such as 1888 or entering an "F" when only "A, B, or C" are options. No attempt was made to verify the accuracy of the data entered.

Thirty variables were evaluated for 24,552 records in 2000 (657,175 possible responses) and for 16,675 records in 2001 (440,077 possible responses) for a total of 1,101,252 possible responses. As seen in Table 1, during both years, only 0.017% of possible responses had obvious errors (0.02% in 2000 and 0.008% in year 2001). During year 2000, most errors dealt with dates that were entered incorrectly. Of the total 146 data entry errors detected in year 2000, 107 (73%) were associated with the Date of Investigation. For example, according to data in MESS, many cases with onset in 2000 were investigated at the turn of the century (i.e., 1900). Of the 37 obvious data entry errors in year 2001, 10 were associated with the date of the last dose of measles vaccine.

However, for both years, numerous fields lacked information. For year 2000, 11.2% of all responses had missing information, i.e., 5% were left blank and 6.2% had a "ZZ" for unknown. During year 2001, 7.7% of fields had missing information, i.e., 3.3% were left blank and 4.4% had a "ZZ."

The amount of missing information varied greatly by variable and by year. In general, year 2001 had less missing information per variable. Some variables such as Date Reported, Onset Date of Rash and Case Classification had no missing information in year 2001.

In 2000, among the 21,273 persons at least one year of age, 6,438 (30%) had no information on measles vaccination status. Among persons who had at least one dose of measles vaccine, 52% had no date of vaccination. In year 2001, the comparable percentages were 21% and 47%, respectively. In year 2000, of 6,483 persons vaccinated against rubella, 78% had no date of vaccination. In the year 2001, 62% of the 4,435 persons vaccinated against rubella had

TABLE 1. Missing information and data entry errors by variables in MESS, the Americas, 2000–2001.

Variable	Year 2000 (n=24,522 registered) Number			Year 2001 (n=16,676 registered) Number		
	Blank	"ZZ"	Error	Blank	"ZZ"	Error
Date reported	46	0	0	0	0	0
Date onset rash	0	0	0	0	0	0
Site type	596	555	1	305	57	3
Type of rash	2,027	394	0	825	211	6
Date investigated	2,183	89	107	1,283	426	2
Source	617	77	1	0	75	0
Case classification	0	0	0	0	0	0
Classification code	67	0	0	582	0	0
Gender	71	40	2	24	14	6
Age	103	237	2	34	49	9
Number of doses (Measles) *	359	6,079	9	334	2,517	0
Date of last measles dose**	1,798	6,440	10	1,056	3,652	10
Fever	1,631	79	2	603	33	0
Date onset fever	199	0	0	131	0	1
Trip	2,341	1,658	6	840	778	0
Conjuntivitis	1,925	544	0	745	213	0
Coryza	1,917	544	0	724	190	0
Cough	1,860	388	1	708	134	0
Contact	2,259	1,893	0	939	960	0
Date of confirmation	297	0	4	3	0	0
Linphatycs	2,017	890	0	819	260	0
Hospitalization	1,894	247	0	0	56	0
Death	1,967	261	1	777	57	0
Initial diagnosis	394	0	0	391	0	0
Final diagnosis	0	5,949	0	0	3,998	0
No. rubella doses *	1,964	4,740	0	732	2,341	0
Date last rubella doses**	433	4,599	0	1,075	1,488	0
Arthralgias	3,406	4,751	0	1,480	1,679	0
Prgnancy status***	309	577	0	132	40	0
Weeks pregnant****	13	16	0	8	13	0
Totals	32,693	41,047	146	14,550	19,241	37

* Among persons at least 1 year of age.
** Among persons ar least 1 year of age and with at least 1 dose of vaccine.
*** Among women 15 years of age or more.
**** Among pregnant women 15 years of age or older.

no information on the date of vaccination.

In 2000, 831 women 15 years of age or more were confirmed to have rubella. Of these, 43 had information stating they were pregnant. However, pregnancy status was missing for 282 (34%). Of the 43 pregnant women with rubella, 7 (16%) had no information entered into MESS on the number of weeks that they were pregnant and 27 (63%) had information stating that they were 1-20 weeks pregnant. During year 2001, 244 women 15 years of age or more were confirmed to have rubella; 14 were pregnant and 18 (7%) had no information on their pregnancy status. Of the 14 pregnant women with rubella, 1 had no information on the number of weeks that she was pregnant and 11 (79%) had information stating they were 1-20 weeks pregnant.

Editorial Note:
National managers should ensure the quality of the data entered into the national MESS databases. This evaluation (which did not address the actual accuracy of the data entered) suggests that there are few obvious data entry errors, and that errors have decreased in the year 2001, when compared to year 2000. However, many variables in many records still lack information. As recommended for MESS, fields lacking information can be left blank at the onset of the investigation. However, upon completing the investigation, variables with missing information should have a "ZZ" entered implying it is truly "missing information" as opposed to not having been collected at the onset of the investigation, i.e., when the field is left blank. While every attempt should be made to obtain all data, some information is more crucial than another, e.g., vaccination history and dates of vaccination. Likewise, information on the pregnancy status of women with rubella must be collected. All infants born to women with rubella during pregnancy must be closely following and evaluated.

June 2002
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Ministers of Health of Andean Region Pledge Support to Halt Measles Virus Transmission

The Ministers of Health of the Andean Region and Chile signed an agreement in the city of Sucre, Bolivia on April 23, 2002, pledging their support to prevent the regionalization of the measles outbreak that is currently affecting Venezuela and Colombia.

In the Sucre Agreement the Ministers of Health of the Andean Region agreed to:

- Provide resources to finance the activities in the Plans of Action of national immunization programs in each country, aimed at interrupting the transmission of measles virus in Venezuela, and preventing the regionalization of measles.
- Carry out programmed national vaccination campaigns on a timely basis, and include measles monitoring and verification of coverage attained at the local level.
- Coordinate the simultaneous implementation of a National Vaccination Week in all Andean countries, beginning in 2003.
- Maintain active epidemiological surveillance of measles at all levels, using active case-finding as a routine strategy in high-risk areas.
- Plan, in coordination with countries' international relations offices, inter-country immunization and surveillance activities, particularly in border areas. The objective is to intensify vaccination, epidemiological surveillance and public information activities within the framework of Resolutions 367 and 368 (Epidemiological Andean Shield), adopted at the meeting of Ministers of Health of the Andean Region (REMSA), November 2001, in Quito, Ecuador.
- Urge the creation and adoption of Vaccine Laws in countries that do not have them, to guarantee the continuity of resources for the procurement of vaccines and other critical inputs, and to ensure timely financing for routine vaccination programs and emergency situations.
- Ensure compliance with the recommendations of the XII Sub-regional Meeting of Managers of National Immunization Programs in the Andean Region, Brazil, and Chile, held on 22-23 April in Sucre, Bolivia.
- Propose as part of the health system reform processes that the steering role of Ministries of Health be strengthened, to ensure that equitable access to vaccination be considered a state responsibility.

The Ministers of Health also agreed to convene their technical teams to work on a set of specific recommendations issued for each country, which are included in an annex of the Sucre Agreement. Furthermore, they resolved to make the topic of vaccine-preventable diseases a permanent item on the agenda of meetings of Ministers of Health of the Andean Region (REMSA).

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Update: Measles Outbreak in Venezuela

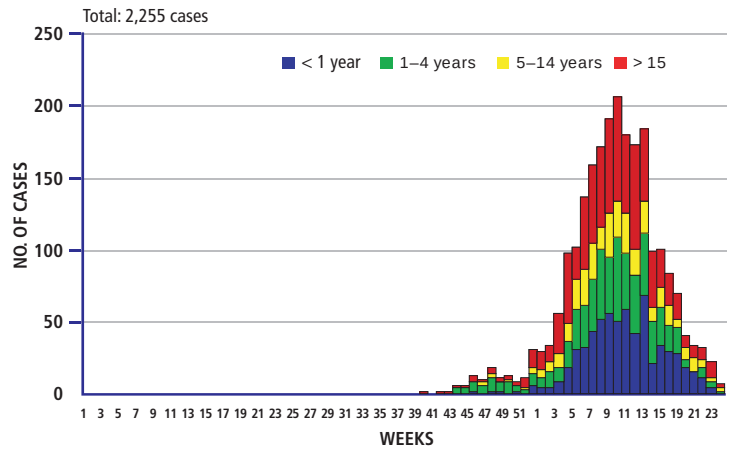
Background

Since August 2001, a measles epidemic resulting from an importation from Europe is ongoing in Venezuela (refer to *EPI Newsletter,* February 2002 for more information on the Venezuela outbreak). As of June 15 (epidemiological week 24, 2002), a total of 6,297 suspected cases have been reported in the country, with a total of 2,255 confirmed cases (Figure 1). These cases are distributed in 15 of the country's 23 states, plus the Capital District. The state most affected is Zulia, which has the highest population and shares an extended border with Colombia. Zulia reported 1,955 confirmed cases during the first 24 weeks of 2002, which account for 83% of the country's total. Following intensive immunization efforts among children and young adults, that were possible due to the high-level commitment of the country's health authorities, measles incidence in Zulia showed a decrease of more than 90% during weeks 23 and 24, compared to the peak of the outbreak in week 11.

Update

Falcon State
As of epidemiological week 50 of 2001 (December 15), the state of Falcon, where the outbreak started, had reported a total of 35 confirmed cases. These were distributed in three municipalities and mainly among unvaccinated people. The attack rate was highest among children <1 year (26.7 per 100,000), followed by 1-4 years (25 per 100,000) and adults 25-29 years (16.7 per 100,000). The majority of infected adults were laborers, students and health workers.

FIGURE 1 Distribution of measles cases by age group and by week, Venezuela, 2000–2002.*



* Up to week 24.
Source: MOH.

The outbreak was stopped after a statewide immunization campaign with measles and rubella-containing vaccine, targeting children up to 15 years of age. In affected municipalities, the campaign included adults as well.

During epidemiological week 5 of 2002, measles reappeared in Falcon State. Transmission first took place in a hospital of the Paraguana peninsula, a major touristic and economic area. Since then, a total of 165 cases have been confirmed up to week 24 of 2002. The main groups affected were the under-1-year and over-20-year age groups, primarily in the Paraguana peninsula. The 1-14 year age group, vaccinated during the November and December campaigns, was practically unaffected. Following the State's control measures, the outbreak has slowed considerably during the last weeks, with sporadic cases in the peninsula, mainly in the Carirubana municipality.

Zulia State
The first case reported in Zulia, situated to the West of Falcon state and sharing a border with Colombia, took place on October 25, 2001, in Maracaibo. The case is a nursing aide from a private health facility that receives many patients from Falcon State. She contaminated 6 other persons in two parishes. On November 16, three suspected measles cases were reported in the San Francisco municipality that borders the Maracaibo municipality and together form the city of Maracaibo, which has the highest population density in the country. One of the initial cases was a 27-year-old male who works as a guard in a health center in San Felipe and visits Falcon State twice a week, specifically the Buchivacoa municipality. The other two cases were a 4- year-old girl, with whom he had had contacts several times, and a 1-year-old boy who lives in the same building as the guard. The outbreak spread to the rest of the State where a total of 72 cases were reported in 2001.

As of week 24 of 2002, the total number of confirmed cases in Zulia state was 2,027 (86.5% of the country's total cases) with all 21 municipalities of the State reporting cases. The most affected age group was that of children under 5 years of age, particularly children under 1 year who presented an attack rate of 685 per 100,000. The young adult groups, mainly those between 20 and 34 years, also showed a high incidence rate, 20-24 years: 68.5 per 100,000; 25-29 years: 52.4 per 100,000; and 30-34 years: 39.5 per 100,000.

At present, reported administrative coverage is above 100% in nearly all of Zulia's municipalities. However, several monitoring activities carried out in different areas show that coverage for children <5 years of age fluctuates between 85% and 95%. The positive impact of such actions are evidenced by the over 90% decrease in the weekly number of cases between epidemiological week 11, the epidemic's peak with 183 cases, and week 19 with 10 cases.

Over the last few weeks, Venezuela has been exporting measles virus to neighboring Colombia due to the extensive border shared by both countries and the vast population movements that generally take place. As of week 24 of 2002, Colombia had reported a total of 60 confirmed measles cases. Although many of these cases are directly related to the Venezuela outbreak, some cases already reflect secondary transmission in Colombia.

Others States
During 2001, only Falcon and Zulia had reported cases. However, starting in week 5 of 2002 and with higher intensity since week 11 (following the Holy Week celebrations that involve major movements of people between states due to tourism, parties, and family reunions), cases have begun to appear in states bordering Zulia state - Lara, Merida, Tachira, Trujillo) and later in seven other states. A total of 101 cases (4% of the country's total) have been confirmed in 2002 in those 11 states, distributed as follows: Lara (26 cases), Merida (18 cases), Tachira (9 cases), Capital District (8 cases), Apure (7 cases), Anzoategui (7 cases), Aragua (5 cases), Vargas (4 cases), Monagas (3 cases), Miranda (2 cases), Trujillo (8 cases) and Cojedes (4 cases).

Contributing factors to the effective control of the outbreak in the Zulia and Falcon States

1. Financial and Political Support
a. Significant mobilization of human resources with additional support received from the Ministry of Health for the measles follow-up campaign of November 2001. In 2002, the political support of the Ministry of Health to control the measles epidemic at the national level has been further strengthened, and priority is being given to the hardest-hit states.

b. In Zulia state, efforts to involve the State Government in the process have been successful. This has resulted in significant financial support through the Regional Directorate for Health. Particularly over the last weeks, regional authorities have increased their commitment and are actively sponsoring local promotion and social communication activities - key components when controlling an outbreak. For the final push in the states of Zulia and Falcon, additional nurses have been hired specifically for immunization and monitoring activities. Furthermore, the majority of vehicles and staff available at the Regional Directorates have been made available for immunization activities.

c. Community participation in the different municipalities, and the use of local health promoters as vaccinators have been critical in Zulia. Similarly in Falcon, community leaders are also participating actively and additional nursing staff has been hired.

d. Sustained technical support provided mainly to these two states by PAHO since the beginning of the outbreak. In addition to funds earmarked for the vaccination teams, 11 seasoned epidemiologists from other countries in the Region have collaborated with the regional teams in planning and monitoring coverage during the last six months.

2. Prioritization ofactivities based on available epidemiological data
a. Good measles surveillance has permitted health care officials to assign priority to the most affected areas and age groups.

b. Strengthening of monitoring in border areas with Colombia and neighboring states, through the establishment of inter-municipal immunization posts and at international border crossings during working hours.

3. Vaccination coverage monitoring
Optimum use of rapid house-to-house vaccination coverage monitoring as an excellent supervision and on-the-spot evaluation tool. This facilitated the identification of zones or areas that required re-visiting by vaccinators and areas that had been adequately immunized.

4. Health authorities and staff's commitment
It is noteworthy to mention the effort and commitment shown by the team of epidemiologists of all the affected states, as well as the commitment of Venezuela's health authorities.

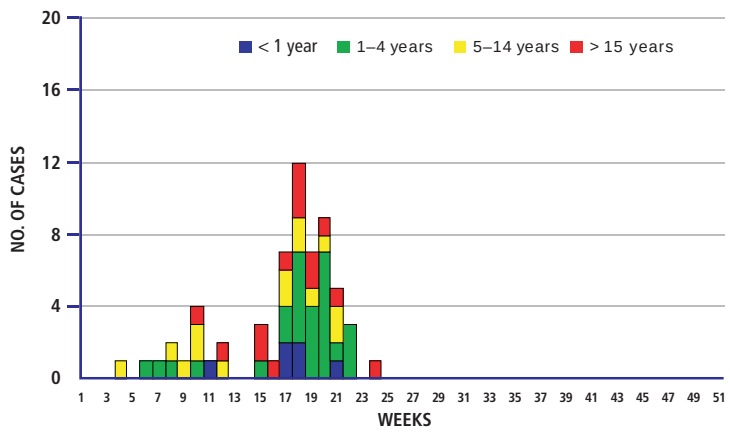
June 2002
Volume XXIV, Number 3

Measles Outbreak in Colombia

Following several years without measles, indigenous measles transmission was established in Colombia, due to an importation from Maracaibo, Venezuela—a 7-year-old girl from Barranquilla, in the Atlantico Department, who was vaccinated at 9 months of age and had rash onset on January 2002. The case is considered the primary case and the source of various chains of transmission that occurred in the Magdalena Department. As of epidemiological week 26, there have been 1,334 suspected cases reported (measles/rubella), of which 68 have been confirmed (Figure 1). As of now, 60 of the 68 confirmed measles cases show a link to an importation from Venezuela.

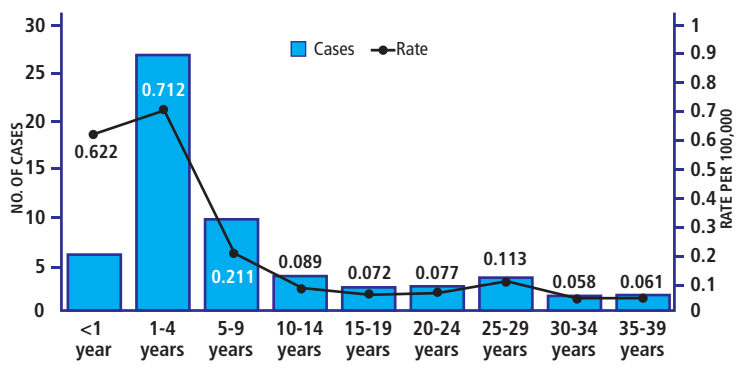
These cases originated from 20 municipalities (Colombia has a total of 1,114 municipalities), and are located in nine of the country's 33 Departments: La Guajira, Norte de Santander, Magdalena (Santa Marta), Atlantico (Barranquilla), Bolivar (Cartagena), Sucre, Santander, Cundinamarca and Bogota. Of the 20 municipalities affected, 14 are considered active since they have reported cases in the last 12 weeks. No cases have been reported with rash onset in the last two weeks. Attack rates by age group are higher in the under-five age group, followed in order of importance by the 5-9 year old and the 25-29 year old groups (Figure 2).

FIGURE 1 Distribution of measles cases by age group and by week of rash onset, Colombia, 2000.*



* Up to week 26.
Source: MOH.

FIGURE 2 Distribution of confirmed measles cases by age group and rate per 100,000, Colombia, 2002.*



* Up to week 26.
Source: MOH.

Control Measures

- Strengthening of Epidemiological Surveillance: Issuing of a national and international alert about the measles outbreak, which led to the doubling of the weekly notification rate of suspected cases compared to previous years.
- Development and Implementation of a Measles Containment Plan: The plan is being implemented in the Atlantic Coast and the capital city of Bogota since the end of 2001, and seeks to contain the circulation of measles virus in those areas due to the constant importations by travelers from the State of Zulia, Venezuela. The containment plan includes the following activities: (i) Indiscriminate door-to-door mass vaccination in all high-risk municipalities located in the Atlantic Coast, targeting all children between 6 months and 5 years of age; (ii) Rapid monitoring of coverage to verify and confirm that useful coverage has been obtained and to prevent pockets of susceptible individuals; (iii) Active search in health facilities and in the community in all the affected municipalities; (iv) Regular training of all health workers on outbreak containment strategies and management of each suspected case.
- Planning of a National Immunization Measles Follow-up Campaign (NID): Indiscriminate measles vaccination of all children between the ages of 6 months and 4 years in the country since April, 2002 and scheduled to end in July.
- Development and Implementation of a Social Communication Plan: Widely publicized social communication plan to be implemented from 22 June to December, 2002. This effort seeks to stimulate the demand for immunization during the NID, and enhance the ongoing flow of information addressing adequate identification of symptoms and signs of a suspected measles case, to ensure its timely detection and reporting.

The implementation of rapid control measures in the country has been critical. This is of particular importance given the high level of migratory movements between Venezuela and Colombia and the fact that the most affected state in Venezuela (Zulia) borders Colombia.

June 2002
Volume XXIV, Number 3

Haiti and the Dominican Republic Join Efforts to Control Polio and Measles on the Island of Hispaniola

Background

Between 2000 and 2001, Haiti and the Dominican Republic, the two countries sharing the island of Hispaniola, were affected simultaneously by a large outbreak of measles and by an outbreak of poliomyelitis caused by a vaccine-derived poliovirus. A total of 13 cases of vaccine-derived polio were confirmed in the Dominican Republic and 8 in Haiti. The outbreak of polio resulted from the prolonged circulation of vaccine-derived poliovirus in areas with very low coverage with oral polio vaccine (OPV), as well as poor sanitation conditions.

For measles, Haiti had completed a nation-wide catch up measles vaccination campaign in 1994, reaching an estimated official vaccination coverage of over 95% of children ages 9 months to 14 years. Following this campaign, Haiti remained free of measles for six years. However, vaccination coverage through routine immunization with measles vaccine in 1 year olds averaged 47% (range 32-85%) between 1995 and 1999. This led to an accumulation of over 1 million susceptible children below age 5. A follow-up measles vaccination campaign was conducted in 1999, but reached an estimated coverage of between 70-80% of the target population of all children between the ages of 6 months and 4 years, approximately 1.3 million children. The main reasons for these results included lack of political will, failure to implement close supervision of vaccinators, and logistical failures in delivering vaccine on time and in good condition.

In response to the situation, the Ministries of Public Health of both countries pledged their commitment to carrying out a series of unprecedented control measures. With the strong support of several international agencies including the Government of Canada, USAID, CDC, Rotary International, the World Bank, and the technical cooperation of PAHO, the epidemics were brought to a halt. For Haiti, the date of onset for the last confirmed case of measles was 26 September 2001, while for vaccine-derived polio the date was 12 July 2001. In the Dominican Republic, the onset date for the last confirmed case of measles was 4 June 2001, and that for vaccine-derived polio was 25 January 2001.

Each country is now completing its vaccination efforts initiated in 2000 and continued through 2001 and 2002. The overall

objective of these campaigns has been to provide at least one dose of measles vaccine and three doses of OPV to each child.

Haiti

Beginning in March 2000, Haiti began a series of measles vaccination campaigns within most of the country's 11 health districts using a mix of door-to-door and fixed-post strategies. These were followed by two national immunization days (NIDs) in early 2001 based solely on fixed-post vaccination strategy that included both measles and oral polio vaccines. Two further NIDs using door-to-door strategy were conducted against both diseases in the summer and fall of 2001. A third NID began 30 May 2002 and will be completed in August 2002. This campaign, to be implemented in close coordination with the health authorities of the Dominican Republic, seeks to vaccinate all children below age 10 against polio, and all children between the ages of 6 and 23 months against measles. Following the vaccination of children below age 10 in all schools in the country for a two-week period in May, groups of two or three health departments will be vaccinated in sequence.

Dominican Republic

In response to the polio outbreak, the Dominican Republic conducted National Immunization Days in December 2000, as well as in February and May of 2001. All NIDs reached a vaccination coverage of approximately 100% with OPV, which was confirmed through field monitoring of vaccination coverage. During the last NID, vaccination against measles was also carried out. Monitoring of coverage performed in all municipalities of the country identified a vaccination coverage of approximately 95%. Previous campaigns against measles failed to reach the recommended coverage, and the circulation of measles had not been interrupted.

The most recent National Immunization Day was carried out between 31 May and 2 June, 2002, targeting all children under 3 years of age. The goal was to reach approximately 700,000 children for polio and 590,000 for measles.

Heightened Coordination between Haiti and the Dominican Republic

Early coordination efforts between the two countries consisted primarily of sharing information and international consultants. However, by late 2001 these had evolved into a series of international meetings at both the national and regional levels. The simultaneous campaigns demanded a high-level of coordination and exchange of information between the two nations. The plan included a formal meeting of senior health officials from the two Ministries of Public Health at the main border area. Furthermore, all children in the target age groups passing through any one of four official border crossings were vaccinated at one of the special vaccine posts situated on both sides of the border. Haiti and the Dominican Republic health staff will continue to exchange surveillance information on a weekly basis to confirm that both diseases remain absent from the two countries.

August 2002
Volume XXIV, Number 4

Towards Measles Eradication in the Americas: The Last Inch?

In 1994, countries in the Region of the Americas set a goal of interrupting indigenous measles transmission by the end of 2000, using a vaccination strategy developed by the Pan American Health Organization (PAHO). Since then, great progress has been made towards the goal. In 2001, the total number of confirmed measles cases in the Region reached a record low of 541 cases, a 99% reduction compared to 1990 (Figure 1). During 2001, the Dominican Republic and Haiti successfully interrupted measles transmission, effectively ending known indigenous transmission of the d6 measles virus genotype. This genotype had circulated widely in the region since at least 1995, causing nationwide outbreaks in Brazil, Argentina, Bolivia, the Dominican Republic, and Haiti during 1997-2001.

A new measles genotype (d9) was introduced to the Region in August, 2001, by a Venezuelan tourist returning from Europe. Since then, until September 7, 2002, a total of 2,491 cases have been confirmed in Venezuela and 125 in neighboring Colombia.

Measles in the Region

Routine (keep-up) vaccination coverage in the Region has increased from 80% in 1994, to 94% in 2000 and 96% in 2001. Measles vaccination coverage for 2000 by country ranged between 75% and 99%. Lowest reported coverage rates were from Colombia (75%), Haiti (80%), Belize (82%), Venezuela and Costa Rica (84%), Guyana (86%), Jamaica and the Dominican Republic (88%). Measles vaccination coverage for 2001 by country ranged between 53% and 99%. Lowest reported coverage rate was from Haiti (53%); all others reported coverage above 80%.

In the Region of the Americas, from 1990 to 1996, measles cases declined from approximately 250,000 to 2,109 confirmed cases. In 1997 there was a resurgence of measles virus circulation, with 53,683 confirmed cases reported, 52,284 (97%) of them from Brazil. The outbreak spread to Argentina and Bolivia, where the largest number of measles cases occurred in the Region during 1998 and 1999, respectively. In 1998, there were 14,332 confirmed cases reported from 17 (41%) of the 41 countries that report to PAHO. Argentina (10,229 cases), followed by Brazil (2,781 cases) had the highest number of cases. During 1999 through 2000, 28 (68%) of 41 countries that report to PAHO, including Cuba, the English-speaking Caribbean countries, and most of Central and South America, reported no measles cases. In 1999, 3,209 confirmed cases were reported from 11 countries, 78% fewer cases than in 1998 and 94% fewer than in 1997 (Figure 1). In 1999, indigenous transmission occurred in four countries: Bolivia (1,441 cases), Brazil (908), Argentina (313), and Dominican Republic (274). Also in 1999, Canada, Chile, Costa Rica, Mexico, Peru, Uruguay, and the United States reported measles importations, but secondary transmission was limited as a result of high measles vaccination coverage. The largest outbreak linked to measles importation occurred in Canada, where 165 confirmed cases were linked to an importation from Bolivia.

In 2000, the number of measles confirmed cases in the Americas decreased to 1,755 (Figure 1). Indigenous transmission still occurred in Argentina, Brazil, Bolivia, the Dominican Republic, and Haiti. Only 16 (<1%) of the 12,010 reporting municipalities in the Region reported confirmed measles cases during this period.

During 2001, a total of 541 confirmed measles cases were reported in the Americas. Indigenous transmission was reported only in three countries, Haiti and the Dominican Republic, in the Hispaniola Island, and Venezuela. Dominican Republic's last confirmed case occurred in June, 2001, and Haiti's last case was reported in September, 2001. In August, 2001, a measles outbreak began in Venezuela, a measles virus from a new genotype (D9) that was introduced by a traveler returning from Europe. During August-December, 2001, 109 measles cases have been reported in Venezuela following this importation. The outbreak spread to Colombia during January, 2002. Since then, Venezuela and Colombia have become the only countries with known indigenous transmission in the Region.

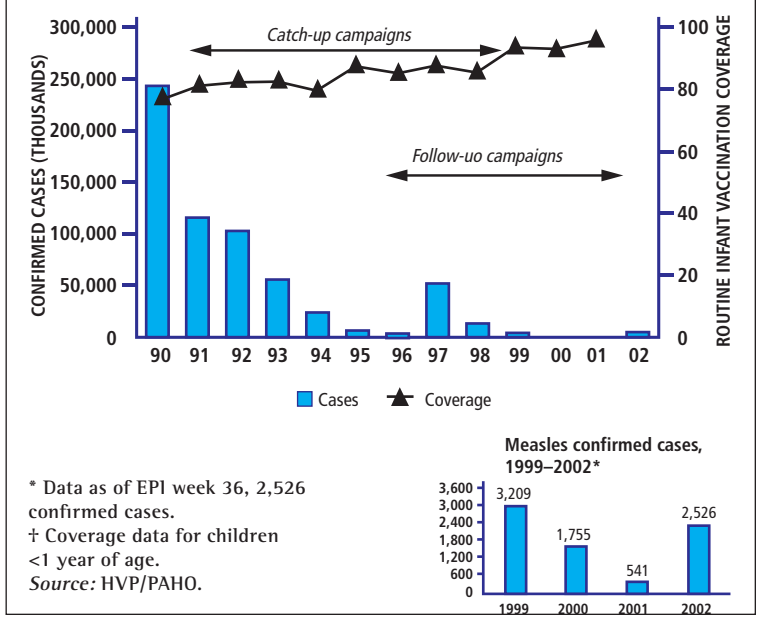
Venezuela

During 1997-2000, routine measles vaccination coverage ranged from 65% to 93%. In September 2001, estimated coverage decreased to 58%, and was lower in states near the border with Colombia (e.g., Falcón, 44%; Zulia, 34%). The source case of the outbreak, a 39-year-old male, had rash onset on August 29, 2001, a day before returning to the state of Falcón from a trip to Switzerland, Germany, and Spain during August 4-30. The first case reported, notified on September 28, was his 35-year-old brother who had rash onset on September 23. Since the beginning of the outbreak until September 7, 2002, Venezuela reported 7,007 suspected measles cases, of which 2,491 were laboratory or epidemiologically confirmed. The outbreak peaked in week 11 of 2002 and has affected 17 (70%) of the 24 States in Venezuela. A total of 2,098 (84%) cases were from Zulia, 202 (8%) from Falcón, and 191 (8%) from the other 14 states. Nationally, the age groups most affected were children aged <1 year (120 cases per 100,000 population), followed by children aged 1-4 years (26 per 100,000), and young adults aged 20-29 years (12 per 100,000).

Measles virus samples were collected from cases in Zulia from November 2001 through January 2002. Genetic sequencing indicated that the virus was not similar to viruses encountered previously in the Region or to the reference genotype strains available on the measles sequence database. A close match was identified from virus samples taken from cases imported into Australia from Indonesia as early as 1999 and which have been given the proposed designation of genotype D9.

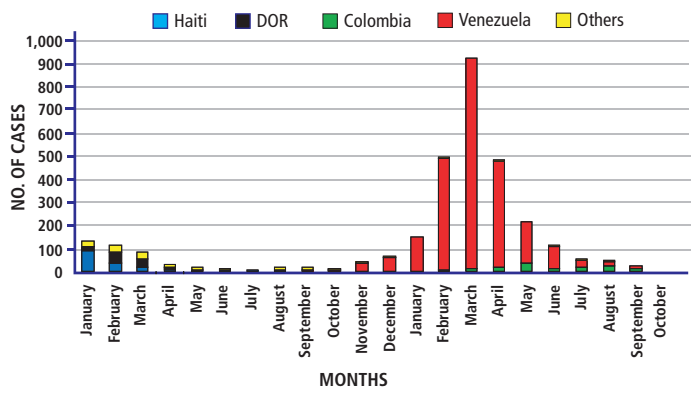
During November, 2001-January, 2002, a follow-up measles vaccination campaign was implemented targeting 2,216,001 children aged 1 to 4 years, 16 of 24 states reported coverage of 100%. Even so, the outbreak continued with cases occurring in all age groups. House-to-house monitoring of vaccination coverage revealed pockets of unvaccinated children. Since March 2002, a nationwide vaccination campaign targeting 5,865,687 children ages 6 months to 14 years and an estimated 5,511,153 high-risk adults in urban, peri-urban and rural areas (including health care workers, tourists, factory workers, soldiers, university students, displaced populations and migrants) was implemented. Since then, measles circulation has decreased significantly. The states most affected, Zulia and Falcón, report no cases since weeks 31 and 20, respectively, and the average number of cases by week during the last 4 weeks decreased to 2.

FIGURE 1 Vaccination coverage and reported measles cases, the Americas, 1999–2002.*†



* Data as of EPI week 36, 2,526 confirmed cases.
† Coverage data for children <1 year of age.
Source: HVP/PAHO.

FIGURE 1 Confirmed measles cases by month, the Americas, January 2001–October 2002.



Source: Country reports as of October 15, 2002.

Colombia

After achieving high vaccination coverage (93%) in 1996, measles coverage declined to around 75% during 1997-2000. Coverage increased to 92% during 2001. The first confirmed case, a 7-year-old from the Atlantic coastal area, had rash onset on January 20, 2002, and reported prior contact with a confirmed measles case in Zulia, Venezuela. As of September 7 (week 36), 3,122 suspected measles cases have been reported in Colombia; of them, 125 had been confirmed as measles. Confirmed cases have occurred in 24 municipalities (14 of them on the Atlantic Coast or bordering Venezuela) from 11 (33%) of the 33 national departments. As of September 7, 2002, the average number of confirmed cases by week for the last 4 weeks is 6.5. The age groups most affected were children age <5 years (1.37 cases per 100,000), followed by children 5 to 9 years of age (0.36 per 100,000), and those aged 25 to 29 years (0.34 per 100,000).

Control activities being implemented include: (a) a door-to-door measles vaccination campaign in high-risk municipalities as part of a national vaccination campaign for approximately 4.2 million children ages 6 months-5 years and other high-risk groups (health workers and travelers), (b) house-to-house vaccination and coverage monitoring in high-risk areas, (c) strengthening of epidemiological surveillance nationwide, and (d) increased training on case investigation and outbreak control all over the country. As of September 15, 2002, 3,362,281 children (80%) in the target group had been vaccinated.

During these outbreaks, measles surveillance has been heightened, using active case searches in both countries, with 3,122 suspected cases detected (7.1 per 100,000 population) in Colombia and 6,380 (26.5 per 100,000) in Venezuela. Technical and financial resources have been provided by international organizations, including PAHO, CDC, and UNICEF and these have contributed to the success of the vaccination efforts.

Editorial Note:

The Region's success in interrupting transmission of the D6 measles virus genotype is evidence that with the commitment of a whole Region to measles eradication the goal can be achieved. The reintroduction of measles and its subsequent transmission in Venezuela and exportation to Colombia are reminders that, until global measles eradication is achieved, countries in the Americas are vulnerable to importations. However, these importations should not result in sustained measles transmission if vaccination coverage is maintained at high levels (>95%) in all municipalities, and measles follow-up campaigns are conducted on time.

The current outbreak in Venezuela and Colombia illustrates, however, the dangers of failing to maintain high routine vaccination coverage, to effectively implement PAHO's recommended follow-up measles vaccination campaigns every four years, and to maintain timely surveillance. Also, experience gained in the Americas throughout the past four years has pointed towards the need of validating the measles vaccination effort at the lowest geographical level through house-to-house monitoring, and to identify localities with persistent low vaccination coverage within countries that report adequate aggregate coverage levels. Based on the results of outbreak investigations in the Americas, PAHO has targeted, during outbreaks, the vaccination of population groups considered at high-risk for sustaining measles transmission and for transmitting measles to susceptible persons of other groups.

To reach, maintain, and assess the interruption of indigenous measles transmission, countries in the Region of the Americas should follow all PAHO recommendations, namely: (a) follow the recommended vaccination strategies (catch-up, keep-up and follow-up), reaching 95% coverage by municipality, (b) monitor coverage house-to-house at the local level during supervisions, vaccination campaigns, and mop-up operations, and implement corrective measures immediately if the vaccination effort has been insufficient, (c) investigate all cases and outbreaks within 48 hours of reporting following PAHO's guidelines, (d) perform routine measles surveillance, validate compliance weekly using PAHO indicators, and perform regular active case searches for surveillance validation, and (e) implement effective infection control measures in health care settings to avoid secondary cases once the disease has been introduced. Full-compliance with these recommendations will ensure that countries of the Region achieve and maintain the interruption of indigenous measles transmission for as long as necessary until global eradication is achieved.

October 2002
Volume XXIV, Number 5

Six Weeks Without Reported Indigenous Measles Transmission in the Americas

Background

Measles is one of the most infectious diseases known to man and remains the leading cause of vaccine-preventable deaths worldwide. Prior to the introduction of the vaccine, practically all children became infected. In 1994, during the Pan American Sanitary Conference, the Americas embarked on the goal of interruption of indigenous measles transmission.

PAHO's recommended strategy for the interruption of measles transmission includes: (a) an initial mass vaccination campaign (catch-up) for children aged 9 months to 14 years, (b) vaccination of children aged >1 year old in routine vaccination services (keep-up), and (c) complementary mass vaccination campaigns every four years (follow-up), for all children ages 1 to 4 years. PAHO has recommended reaching a 95% vaccination coverage in every municipality of the countries. This strategy is complemented by (a) a sensitive surveillance system capable of timely detecting suspected measles circulation, (b) the confirmation and thorough investigation of all cases, (c) an effective virologic surveillance system, and (d) strong supervision of vaccination activities, including rapid house-to-house monitoring of vaccination coverage.

In the Americas, from 1990 to 1996, measles cases declined from approximately 250,000 to 2,109. In 1997 there was a resurgence of measles virus circulation, with 52,284 confirmed cases reported from Brazil, which started with a large urban outbreak in São Paulo. The virus strain that caused the outbreak was D6, which had been circulating since at least 1995 in Brazil and possibly other countries of the Region. The D6 outbreak spread to Argentina and Bolivia, where the largest number of measles cases occurred during 1998 and 1999, respectively, and then to the Dominican Republic and Haiti, which had the largest number of cases in 2000 and 2001 (Figure 1). Sustained vaccination efforts by these countries led to the progressive decrease of cases region-wide to 3,209 in 1999, and 1,754 in 2000. In 2001, the total number of confirmed measles cases had dropped to 541, the lowest yearly number since the beginning of the hemispheric measles initiative. Since September, 2001, no other viruses of the D6 strain have been identified in the Americas. Moreover, numerous countries with high measles vaccination coverage, including Brazil, Canada, Chile, Costa Rica, El Salvador, Chile, Mexico, Peru, United States, and Uruguay, had measles importations during 1999-2002 with limited or no secondary transmission. In August, 2001, after an importation from Europe, a new measles outbreak began in Venezuela and spread to neighboring Colombia (Figure 1). The virus responsible was a new measles strain, D9, never before identified in the Americas. Following important vaccination efforts in both countries, these outbreaks are being controlled. As of October 15, 2002 and since the beginning of these outbreaks, a total of 2,495 cases in Venezuela, and 128 in Colombia have been confirmed. The last confirmed case occurred in Venezuela in September 20, 2002. Since then, no other indigenous measles cases have been reported. This represents the longest period without reports of indigenous measles transmission since the Regional Plan of Action for Measles Eradication was implemented in 1996.

Editorial Note:

By interrupting region-wide the indigenous transmission of at least one measles strain (D6) for over a year, by experiencing an unprecedented six weeks without reports of any indigenous measles, and by experiencing repeated measles importations with limited or no secondary transmission, countries of the Americas have shown that global measles eradication, following PAHO's recommended strategies, is possible. Nonetheless, intensive active search for cases in areas of civil unrest in Colombia, and areas of Colombia and Venezuela that still maintain either low measles coverage or insufficient surveillance will be needed to confirm that indigenous measles transmission has effectively been interrupted.

To maintain the Region free of indigenous measles transmission in the absence of global measles eradication, all countries in the Americas will need to: (1) achieve and maintain high (>95%) vaccination coverage by municipality during both routine and follow-up measles vaccination, and (2) maintain strong surveillance and case investigation efforts.

December 2002
Volume XXIV, Number 6

XV Meeting of the PAHO Technical Advisory Group

The XV Meeting of PAHO's Technical Advisory Group on Vaccine-Preventable Diseases (TAG) was held in Washington D.C., November 22-23, 2002.

The Technical Advisory Group on Vaccine-Preventable Diseases of the Pan American Health Organization (TAG) continues to be impressed by the very capable and imaginative programs now in progress to deal with the vaccine preventable diseases in the Americas. The programs have been pioneering efforts that other countries and regions are now striving to emulate. Indeed, the pace of progress over the past 25 years in controlling these diseases and in decreasing childhood morbidity and mortality rates is unprecedented. The remarkable successes achieved reflect an extraordinary partnership of efforts on the part of country governments and health staff; public and private donors; with exceptional leadership being provided by the Pan American Health Organization.

It is important that these efforts be sustained and, to this end, TAG reaffirms the importance of the target of 95% vaccination coverage with all antigens in every municipality and the need for countries to have functioning surveillance systems that generate reliable and timely information. It also recommends that all countries implement and verify compliance with school immunization laws that make it mandatory for children entering preschool and school to have their vaccination records checked for completeness in meeting the national immunization schedule recommendations.

Measles

Remarkable progress has been made in the Americas towards reaching the goal of interrupting indigenous measles transmission. Sustained political, financial, and social commitment and sound strategies have made the interruption of endemic measles transmission in the Americas an achievable goal. The full implementation of PAHO's recommended strategy in all countries remains the keystone of efforts towards the interruption of indigenous measles transmission. Countries that have failed to either conduct timely follow-up vaccination campaigns, or to sustain high-levels of vaccine

induced measles immunity, have experienced large outbreaks following measles introductions.

TAG commended the joint efforts of the World Health Organization and UNICEF, with the collaboration of the Centers of Diseases Control and Prevention, in launching the Strategic Plan 2001-2005, aimed at global measles mortality reduction and regional elimination.

Recommendations

Recognizing the important advances made in the Americas towards the interruption of endemic measles transmission, and based on the lessons learned from recent outbreaks, TAG reaffirms its recommendations issued during the 2000 meeting.

- Vaccine program managers should identify areas at high risk for outbreaks, such as those of extreme poverty, as well as densely-populated areas in the outskirts of large cities with high rural to urban migration. Administrative vaccination coverage in these areas should be assessed using PAHO's standardized supervisory tools. Vaccination interventions should be implemented in areas with low coverage. In order to improve overall immunization coverage, countries should identify municipalities falling below the national average coverage and implement strategies to improve coverage in those areas. Efforts should include reducing missed opportunities, supplemental (mop-up) vaccination and other outreach efforts. Progress should be evaluated through regular supervision and validation of coverage levels through rapid house-to-house monitoring. Model demonstration projects should be undertaken to develop valid and operationally feasible methods to identify these high-risk populations, and to develop effective means to improve coverage. The impact on center and community specific coverage levels should be assessed pre- and post-intervention. Results from these demonstration projects should be presented at the next TAG.

- Countries should especially target vaccination of health care workers who work in emergency room, or who see acutely ill patients, and other at-risk populations groups based on a country's epidemiology.

- Special efforts should be made to better understand the epidemiology of measles importations, and factors that contribute to sustaining large outbreaks, including the chief settings of transmission.

Measles and Rubella Laboratory Network

The vast majority of suspected measles and rubella cases in the Region have adequate serum samples taken. In general, regional laboratory indicators demonstrate that the laboratory network is functioning at a high level of performance. In addition, testing results of quality control panels demonstrate a very high level of laboratory competence. However, several areas of concern are noted. First, few countries have been able to ensure that 80% of specimens arrive to the laboratory in a timely manner. Second, far too few samples for viral isolation are being collected and tested for measles by the network. Even fewer specimens are being tested for rubella virus isolation. This may, in part, be due to the need for increased coordination and communication between clinicians, epidemiologists and laboratory staff. Regardless, viral isolation is critical to ensure determination of genotypes, for evaluation of the measles program in the approaching post-elimination phase, as well as to determine the extent of rubella transmission in the hemisphere.

Finally, it is important to keep in mind that countries should expect to see laboratory false-positive cases. To this end, laboratory procedures to establish which laboratory results are false-positives are available. In addition, confusion continues to exist on the proper management of recently vaccinated cases that are found, as could be expected, to be IgM-positive. PAHO has also published guidelines on the proper management of such cases.

Recommendations

- National managers should ensure that the guidelines recommended by PAHO for evaluation of rash illness associated with vaccination are followed to establish the final classification of such cases. Managers should not assume that a rash illness in a recently vaccinated case is always due to the vaccination. All cases that are laboratory positive should carefully be investigated to ensure they are not measles or rubella, such as determining whether there are potential source cases with rash and fever, and whether there has been subsequent transmission.

- National laboratories should be commended on their participation in, and the results from, quality control panel testing. All laboratories should continue to participate in these quality control programs. Program managers should ensure that all sera from suspected cases are tested for both measles and rubella antibodies. In addition, special emphasis should be placed on the collection of specimens for viral isolation and the logistics necessary to ensure that adequate specimens are taken and are shipped appropriately.

Measles: Lessons Learned

Given that measles is highly endemic in other regions of the world, the Americas continue to be under constant threat of importation of measles virus from other regions where the disease remains endemic. Measles importations have been responsible for outbreaks in Argentina, Bolivia, and the Dominican Republic in 1998-1999, in Haiti in 2000-2001, and in Venezuela in 2001-2002. Measles importations are unavoidable; therefore, the main strategy to prevent the re-initiation of endemic measles transmission is to maintain the highest population immunity possible through high vaccination coverage in all municipalities.

Lessons learned from recent outbreaks following importations have highlighted that densely populated and underserved peri-urban areas with high rural-to-urban migration are at highest risk for measles outbreaks, primarily because of the accumulation of large number of susceptible persons, especially unvaccinated young children. Some areas have had a false sense of security because coverage obtained through the administrative method has been substantially higher than coverage obtained through house-to-house monitoring.

Another critical lesson emerging from recent outbreaks calls for the need to develop strong and accountable supervisory methods and tools to improve the assessment of vaccination and surveillance efforts, particularly at the local level. Experience from the Americas shows that programs with systematic and thorough supervision, including active case-finding, house-to-house monitoring and follow-up can successfully interrupt measles transmission.

Outbreak investigations performed in the Region continue to show that the group at highest risk for measles is unvaccinated young children. Another group at high risk of acquiring and/or transmitting the disease is health care workers, especially those who work in emergency rooms or who treat acutely ill patients.

Another important finding has been the persistent late reporting of cases in some areas, as well as insufficient participation by private sector providers in surveillance efforts. These have affected a country's ability to detect measles outbreaks and implement control measures in a timely fashion.

Of greatest concern are the large municipalities in the Region, which because of high population density and large numbers of migrants from rural areas are at greatest risk for sustaining measles transmission, should it be introduced. Within these municipalities, there are likely to be high risk sub-populations (characterized by poor access to health services, poverty, high-population density, and large numbers of migrants).

2003

February 2003
Volume XXV, Number 1

19 Weeks Without Reported Transmission of the D9 Measles Virus in the Western Hemisphere!

In 1994, the Region of the Americas adopted the goal of measles eradication. The regional plan of action for achieving this goal was endorsed by all ministers in 1995. As of March 28, 2003, the Western Hemisphere is free from known circulation of the D9 measles virus for an unprecedented 19 weeks. This is further evidenced by the Region's strong surveillance.

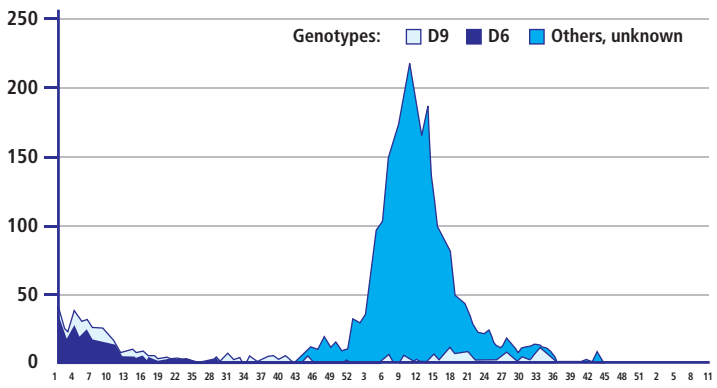
The Pan American Health Organization's recommended vaccination strategy includes: 1) a one-time nationwide campaign targeting children aged 1 to 14 years; 2) routine vaccination among 1-year-olds; and 3) nationwide follow-up campaigns conducted every ≤4 years, targeting all 1-4 year olds. Rapid house-to-house monitoring for validation of the vaccination effort at the local level and active epidemiological and virologic surveillance are other key components of the strategy.

During 1997-2001, reported confirmed measles cases in the Western Hemisphere decreased from 53,683 to a record low of 541. In September 2001, known transmission of the measles virus of genotype D6, which had circulated in the Region since at least 1995, causing large outbreaks in Brazil, Argentina, Bolivia, the Dominican Republic and Haiti, was interrupted. That same month, a new measles genotype (D9) was introduced in Venezuela, by a traveler from Europe and resulted in an outbreak that spread to neighboring Colombia during January 2002. This outbreak occurred due to sustained low routine vaccination coverage in Venezuela. Unlike Venezuela, Colombia did not have a large build-up of susceptible children, and therefore control of the outbreak was more easily achieved. Following nationwide vaccination efforts by both countries, transmission of the (D9) measles virus was also interrupted. The last case occurred in Carabobo, Venezuela on November 16, 2002. The total number of cases during the outbreak was 2,501 in Venezuela and 140 in Colombia.

As of March 28, 2003, no circulation of the D9 measles virus has been reported anywhere in the Western Hemisphere for 19 weeks, despite strong surveillance efforts that included the reporting of 1,173 suspected cases, of which 191 (16.3%) are still under investigation and 7 (0.6%) were confirmed. Confirmed, sporadic cases have been reported from Canada (4), and the United States (3).

This unprecedented achievement is a result of sustained high political commitment by Member Countries and full implementation of PAHO's recommended measles control strategies. It further demonstrates that global measles eradication is an achievable goal. Nonetheless, important challenges remain. Measles is still endemic in other regions of the world and sporadic cases continue to occur in the Western Hemisphere due to importations. Most countries have not sustained 95% routine measles vaccination coverage in all municipalities. Poor and underserved neighborhoods in large cities that attract migrants of rural origin are particularly at risk of measles outbreaks when the virus is reintroduced. Therefore, countries of the Americas have initiated interventions targeting people living in these areas for vaccination.

FIGURE 1 Measles cases and main circulating genotypes by week, Region of the Americas, 2001–2003.



* Data as of EPI week 12 (March 28, 2003).
Source: Country reports.

June 2003
Volume XXV, Number 3

Importation of the H1 Measles Virus in Mexico City, April 2003

New measles cases were reported to the Epidemiological Surveillance System on Febrile Rash Illnesses (FRIs) in the Federal District (DF) and the States of Mexico and Hidalgo between April and July 2003.

The first known case of this outbreak occurred in Mexico City, the most populated urban area of the Americas, and had onset date of 13 April 2003; the last case had onset date of 4 July. Nineteen cases were laboratory confirmed, 15 of them in the DF and 4 in Mexico State. The total number of known cases is 22, with 3 cases (all in the Federal District) being epidemiological contacts of confirmed cases (Figure 1). The source of infection could not be identified in 12 (55%) of the 22 cases. Based on the number of reported cases, it is assumed that the real number could have been 32 (22 known cases and at least 10 unknown). Serological diagnosis was performed using the ELISA test for detection of measles IgM at the national epidemiological reference laboratories of Mexico, InDRE (Instituto de Diagnóstico y Referencias Epidemiológicas), and at the Centers for Disease Control and Prevention (CDC), in the US. Furthermore, pharyngeal and urine samples were collected for culture and polymerase chain reaction (PCR) analysis at both institutions.

Of the 22 known cases, 18 live in 5 jurisdictions of the Federal District and 4 in the jurisdiction of Ecatepec, Mexico State (Figure 2). Six cases (27%) occurred in children under 1 year of age; 5 (23%) in preschool children aged 1-4 years; 2 (9%) in the 5-14 year old age group; 2 (9%) in the 15-24 year old age group; and the remaining 7 (32%) in adults between 25-44 years old (Figure 3). Twelve (55%) of the cases are between 6 months and 9 years old and 7 are (32%) between 20 and 30 years old. The highest attack rate (0.9 per 100,000) was among children under age 1. Of the 7 cases in children between 1-9 years old (who, in accordance with the national immunization schedule, should have received one or two vaccine doses), only one (14%) had been vaccinated. If one child aged 1 year and 3 months is excluded from this analysis (window of opportunity), the percentage would be 17%.

Sixteen of the cases belong to five possible chains of transmission, with between 2 and 6 known cases each. The chain of transmission has not been identified in the 6 other cases. Three of the cases occurred in health workers between 27-36 years old, who infected a minimum of 6 people. These 9 cases (41% of the total of 22 known cases) were avoidable, since health workers are supposed to be vaccinated. A 27-year-old infected nurse of the Federal District consulted several physicians who did not consider measles as a diagnosis. Fifteen (68%) of the 22 known cases occurred in families whose members work in factories and mobile markets, are laborers or are involved in prostitution. At least seven (32%) of the cases occurred in people of rural origin.

Virus Identification and Origin

The molecular biology analysis carried out by the CDC in Atlanta on samples from two cases showed that they belonged to the H1 strain and were very similar to the H1 strain currently circulating in Japan. The source of importation, however, has not been identified. Preliminary data from a PCR analysis indicate the virus bears a three-nucleotide difference with the H1 virus isolated from an importation from Japan to Chile this year. The H1 genotype virus has recently been identified in Korea and China. This suggests that the source of importation originated from this Asian region.

Vaccination Coverage

According to data from PROVAC (automated information program for vaccination coverage), national immunization coverage rates as of December 2002 were 85% among children under 14 months old, 95% among 1 year-old children, 98% among two year-olds, and at least 99% among children less than 5 years. This coverage has been maintained during the last four years. Rapid coverage monitoring conducted in several States according to WHO methodology over several years usually showed similar or higher rates. The last follow-up campaign, carried out in 2002, only targeted children between 1-4 years living in municipalities with coverage below 95% and municipalities not reporting FRIs. Two catch-up campaigns were carried out, one in 1993 and the other in 2000, with coverage rates close to 95%. MMR immunization coverage in

FIGURE 1 Confirmed measles cases in Mexico, 2003.

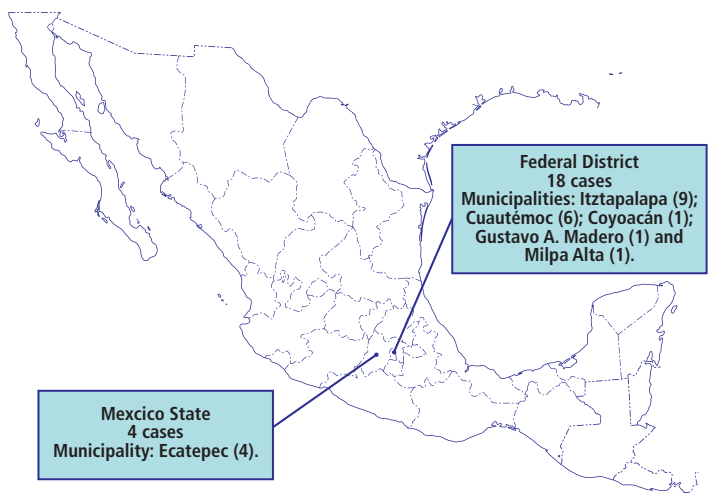


FIGURE 2 Measles cases by week of onset and age group, Mexico, 2003.

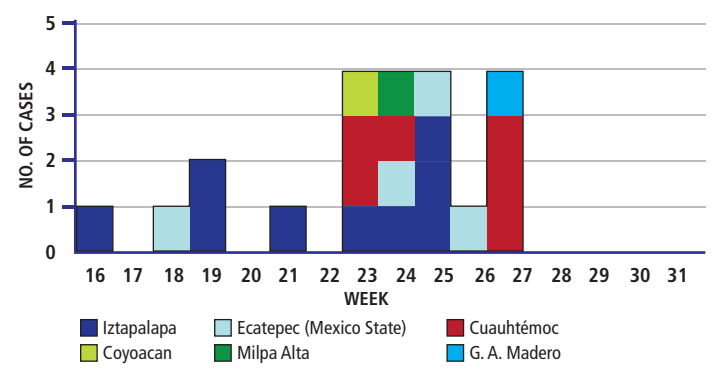
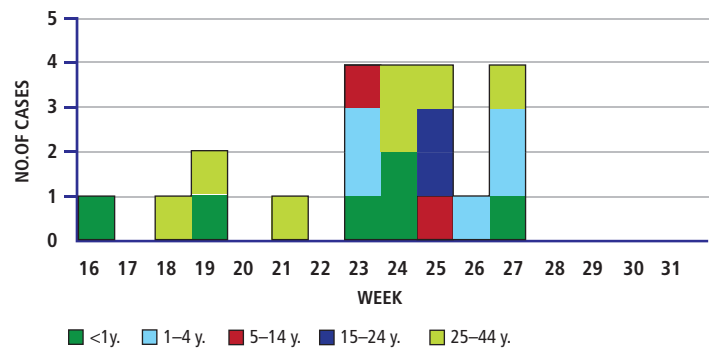


FIGURE 3 Confirmed measles cases according to week of onset and age group, Mexico, 2003.



the Federal District as of May 2003 was 85% among 1-year old children and 93% among children between 1-4 years old, an uninterrupted improvement since 1999. Rapid coverage monitoring carried out in the Federal District in 2002 showed coverage figures higher than the official numbers.

Activities Carried Out

Activities in affected areas of the Federal District and Mexico and Hidalgo States have been implemented in a coordinated fashion among federal, state and local levels with participation of all health institutions. These activities have specifically included:

1. Clinical and epidemiological case studies;
2. Active case search, search around homes of confirmed cases, at job sites, day-care centers, mobile markets, and schools;
3. Vaccination of susceptible population and children 6-11 months old;
4. Retrospective case-finding in health units;
5. Rapid coverage monitoring.

Additional vaccination activities in at-risk areas and among at-risk groups are being carried out by the health services of the Federal District and the States of Mexico, Puebla, and Hidalgo.

Editorial Note:

This outbreak highlights several important issues for maintaining the achievements of the measles elimination initiative in the Americas. As long as measles virus circulates in other parts of the world, the countries of the Americas will always be at risk for importations and subsequent outbreaks. Fortunately, the data from Mexico suggest that the importation of measles virus did not lead to widespread transmission. To reduce the risk of widespread transmission after importation, as happened in Venezuela in 2002, we must maintain high levels of measles vaccination coverage in all municipalities and high-quality surveillance. Monitoring measles vaccination coverage in all municipalities and targeting those with <95% coverage for special vaccination activities remain essential strategies in all countries. That, coupled with the implementation and maintenance of high-quality surveillance, will be the first line of defense to prevent widespread transmission when importations occur.

Conclusions

In view of the above, we can conclude that the first cases of the outbreak were due to an importation of the wild measles virus, H1 genotype, probably imported from Japan or Korea. Once the outbreak was detected, case investigation was performed in a detailed and specific manner, allowing for the identification of several risk groups. Laboratory work was efficient and timely.

Although available information suggest the outbreak stems from a single importation, probably from Japan or Korea, the lack of identification of the source of contagion in at least 12 cases and the lack of viral isolates from those cases without known source of infection prevent us from being conclusive. The continued virus circulation in 8 neighboring jurisdictions in the center of the country for three months, the high percentage of cases (82%) among non-vaccinated individuals who do not belong to the target group of the universal vaccination program (under 12 months or over 6 years), and the number of cases without an identified infection source are reasons to fear that, had control measures not been implemented throughout the country in a timely fashion, virus circulation could have spread to other jurisdictions and other States.

Given the large number of international travelers arriving into the country, the fact that Mexico is a popular tourist destination, and the wide measles circulation in some countries of other regions (Japan, Korea, China, etc.), the frequent emergence of imported measles cases is unavoidable. Although immunization coverage rates at the national level are among the best in the Americas, the conditions in some municipalities not reporting FRIs could allow the reintroduction of endemic transmission, whether due to this importation or another.

October 2003
Volume XXV, Number 5

Andean and Southern Cone Sub-Regional Meetings on Vaccine-Preventable Diseases, 1-3 September 2003

The XIII Meeting of the Andean Region countries and the XVII Meeting of the Southern Cone countries on Vaccine-Preventable Diseases were held as a joint event in Lima, Peru during 1-3 September 2003. PAHO has been promoting these sub-regional meetings for two decades to evaluate progress in controlling vaccine-preventable diseases. This article summarizes the final report and recommendations regarding the elimination of measles.

Measles in the Americas

Currently, indigenous measles transmission is interrupted in every country in the Hemisphere. In 2002, there were 2,583 confirmed cases in the Region, most occurring in an outbreak in Venezuela (n=2,392 cases) and Colombia (n=139 cases). The last confirmed case of this outbreak occurred in Venezuela during week 47 of 2002. The viral strain isolated in this outbreak was D9, an import from Germany. Since then, no indigenous measles circulation has occurred in the Region. In 2003, up to epidemiological week 34, four countries in the Region reported confirmed cases of measles: Mexico (40), the United States (34), Canada (12), and Chile (1), with all cases related to imported strains.

Measles Vaccination in the Andean and Southern Cone Subregions

All of the countries in the Andean and Southern Cone Subregions currently use the MMR (measles-mumps-rubella) vaccine in their routine immunization programs. In 2002, all of the Andean and Southern Cone countries achieved over 90% coverage with measles-containing vaccine (MCV), except for Paraguay, Ecuador, and Venezuela (Table 1). In the first semester of 2003, Venezuela achieved 100% coverage.

Of concern in 2002 was the percentage of municipalities in each country with MCV coverage <95% in children aged 1 year. It ranged from 19% in Ecuador to 64% in Bolivia; Uruguay achieved 94% coverage (Table 2). Low coverage poses a serious risk for widespread transmission in the event of an imported case.

Using the estimation of number of susceptible persons, most of the countries have appropriately scheduled their follow-up campaigns for 2005 and 2006 (Table 3). Brazil has scheduled its next follow-up campaign for 2004.

All of the countries carried out rapid coverage monitoring (RCM) during the June Vaccination Week in the Americas (VWA). However, most countries have not yet mandated that this be a routine supervisory activity.

Epidemiological Surveillance

The Andean and Southern Cone countries have integrated measles and rubella surveillance. Emphasis is placed to ensure speedy and adequate investigation of suspected cases and conduct active case-finding. However, a decline in the number of reported suspected measles cases has been observed.

Surveillance indicators show that all countries have met the target for the proportion of cases with adequate samples. All of the countries, except Venezuela, have met the target for the proportion of samples with results in ≤4 days (Table 4). However, several countries did not achieve the 80% target for the following three indicators: (1) proportion of units reporting weekly (Uruguay and Bolivia); (2) proportion of suspected cases investigated in ≤48 hours (Argentina, Chile, Paraguay, Colombia, and Ecuador); and (3) proportion of cases with samples reaching the laboratory in ≤5 days (Brazil, Paraguay, Colombia, Peru, and Venezuela).

Recommendations

The last confirmed case of indigenous measles occurred approximately one year ago. However, the potential for importation remains a constant threat, since circulation of the virus has still not been interrupted on other continents. Thus, the following activities are crucial to preventing its reintroduction and/or resumption of indigenous circulation in the Region:

- Countries should maintain uniformly high levels of routine vaccination coverage (≥95%) in the health services.

TABLE 1. Vaccination coverage in the Andean and Southern Cone Sub-Regions, 2002.

Country	OPV3	DPT3	Measles	BCG
Argentina	93.7	92.5	95	100
Brazil*	97	96	93.2	100
Chile	95.8	95.4	95.6	94.2
Paraguay	87	87	86	83
Uruguay	93	93	93	99
Bolivia	100	98	100	100
Colombia	82.8	80.4	93.3	87.2
Ecuador	90	89	80	100
Peru	94.5	94.8	95.2	92.1
Venezuela	77	63	78	90

In Brazil, YF coverage age = 98.4%, Hib = 90.1% and HepB = 88.8%.

TABLE 2. Number and percentage of municipalities by coverage level with measles vaccine in children aged 1 year – 2002.

Country	Coverage <95%		Coverage ≥95%	
	Number	Percentage	Number	Percentage
Argentina	273	49	282	51
Brazil	3,057	55	2,503	45
Chile	158	46.3	183	53.7
Paraguay	167	72	63	28
Uruguay	16	6	253	94
Bolivia	113	36	201	64
Colombia	732	65.7	383	34.3
Ecuador	135	81	32	19
Peru	944	51.6	884	48.4
Venezuela	209	57.3	156	42.7

TABLE 3. Follow-up vaccination campaigns.

Country	Year of last mass campaign	Coverage (%)	Date of next campaign
Argentina	2002	87	2005
Brazil	2000	100	2004
Chile	2001	100	2005
Paraguay	2003	93	2006
Uruguay	2003	95	2007
Bolivia	2003	95	2007
Colombia	2002	94.5	2006
Ecuador	2002	100	2006
Peru	2001	97	2005
Venezuela	2001	98	2005

TABLE 4. Measles surveillance indicators – 2003.*

Criteria	ARG	BRA	CHI	PAR	URU	BOL	COL	ECU	PER	VEN
% units reporting weekly	94	83	95	88	17	N/D	88	85	99	80
% suspected cases investigated ≤48 hours	40	81	63	61	100	100	51	42	100	96
% cases with adequate sample	94	80	100	100	100	100	95	99	98	99
% cases with sample arriving in la ≤5 days	80	65	86	79	100	80	69	89	56	60
% samples with results ≤4 days	82	82	98	100	100	80	80	91	88	70

* Up to Epi week 35.
N/D: No data
Note: Acceptable percentages are ≥80% for each indicator.

- Timely national follow-up campaigns should be conducted based on an analysis of the number of susceptible persons.
- Local epidemiological surveillance should be improved by strengthening active case-finding activities to permit the timely identification and investigation of suspected cases.
- Countries should identify high-risk municipalities, considering certain parameters such as <95% coverage, presence of indigenous and migrant populations, border areas, hard-to-reach areas, and areas with high population density or tourism.
- Rapid coverage monitoring should become a regular supervisory activity, emphasizing epidemiologically silent and high-risk municipalities.
- Information systems and data quality should be upgraded at all levels.
- Populations at risk should be vaccinated, including health workers, people employed in tourism, teachers, military personnel in barracks, and prison inmates.
- Countries should guarantee regular and timely delivery of vaccines and other supplies that will make ongoing vaccination activities possible.
- Supervision and monitoring should be strengthened at all levels, making high-risk municipalities a priority.
- Countries should implement an ongoing information, education, and communication (IEC) strategy to strengthen the regular EPI.
- Countries should promote greater coordination of cross-border activities.
- Operational personnel should be kept informed about surveillance, vaccination norms and procedures.
- Countries should maintain integrated measles and rubella surveillance.

Laboratory Indicators for Measles Diagnosis

In 2003 (as of epidemiological week 33), all countries of the Region had higher proportions of suspected cases with adequate samples and timely laboratory response compared to the same period of 2002. The two exceptions were Colombia and Venezuela, where slightly lower values were reported in 2003.

A recurring problem in all of South America is the low proportion of samples reaching the laboratory within 5 days of collection, which ranged from 56% (Peru) to 100% (Uruguay) during weeks 1-33 of 2003 (Table 4). Of the ten countries in the Andean and Southern Cone Sub-Regions, 5 achieved ≥80% for this indicator.

Recommendations

- The indicator for samples reaching the laboratory should be adopted as a measure for monitoring the quality of the surveillance system in each country since it is directly related to the efficiency of the surveillance system, not to laboratory performance.
- Laboratories should continue to participate in the external quality control programs of the Centers for Disease Control and Prevention (CDC) in Atlanta; it is proposed that a panel of 5 samples be sent once a year to each laboratory. The results of the external quality control should be analyzed to prioritize training and supervision needs in the laboratories.
- Countries should continue to collect samples for viral isolation (urine, nasopharyngeal swab) in all outbreaks of febrile rash illness, from every clinical case with a high suspicion of measles and/or rubella and from IgM-positive cases.
- In cases found to be IgM-positive for measles, a thorough epidemiological investigation should be conducted; in cases in which the diagnosis is uncertain, a second serum sample should be collected two to three weeks after the first. These samples (first and second) should be assayed for IgM and IgG measles antibodies. They may also be assayed for other viral infections in network laboratories. All cases should be documented and presented at the next meeting of the Technical Advisory Group (TAG).
- Countries should promote the formation of ad hoc groups to document cases that are IgM-positive for measles; the documentation will be gathered by the surveillance system of each country for subsequent presentation at the TAG meeting.
- PAHO should continue providing measles and rubella reagent kits to the regional laboratory network.
- The laboratory network should collect and disseminate pertinent scientific information about the possibility of obtaining another laboratory test for measles IgM, with a view of optimizing laboratory diagnosis of sporadic IgM positive cases.
- In accrediting measles laboratories, an initial assessment of conditions in the laboratories should be performed to identify support and training needs.

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Global Meeting for Sustainable Measles Mortality Reduction and Immunization Systems Strengthening, 15-17 October 2003, Cape Town, South Africa

International health leaders joined together in Cape Town this month under the sponsorship of the World Health Organization (WHO) and the United Nations Children Fund (UNICEF) to pledge their commitment to reduce measles deaths and describe proven strategies to sustain the prevention of these deaths.

Despite the availability of a safe, highly effective, and relatively inexpensive vaccine for over 40 years, measles claims the lives of an estimated 745,000 children each year - more than half of them in Africa. Of all the vaccine-preventable diseases, measles remains a major killer of children and causes serious complications, such as blindness, encephalitis, and pneumonia. It is the leading cause of vaccine-preventable deaths among children and the fifth leading overall cause of death among children aged <5 years.

Increasing measles vaccination is a critical factor to achieve the target set at the United Nations General Assembly Special Session (UNGASS) on Children in 2002 to reduce measles deaths by the end of 2005 by 50% compared with 1999 levels. It is also a critical indicator for the Millennium Development Goal (MDG) for reducing mortality in children aged <5 years by two-thirds by 2015. With the launch of the Cape Town Measles Declaration (see following page), world health leaders are affirming their commitment to achieve this tangible public health goal.

Immunization Strategy

In May 2003, the World Health Assembly (WHA) passed a landmark resolution requesting countries to contribute actively towards achieving the UNGASS and MDG goals without further delay. The resolution urged Member States to fully implement the WHO/UNICEF recommended immunization strategy for sustainable measles mortality reduction and to use this approach as a tool for strengthening national immunization programs.

The strategy is one of high routine vaccination coverage combined with mass campaigns and it has proven to be extremely effective. Measles vaccination campaigns are conducted to vaccinate all children aged <15 years. Follow-up campaigns are conducted three to four years after the initial mass campaigns, targeting all children aged <5 years born after the last mass campaign. Other essential components of the strategy include establishing laboratory networks and improving measles surveillance to detect and respond to outbreaks.

Experience in the Americas

Routine immunization, periodic supplementary activities, and enhanced surveillance have proven to be very successful in Latin America. The number of deaths caused by measles was reduced to zero after vaccination campaigns during the 1990s. There have been no new cases of indigenous measles for almost a year (last case in November 2002), and all subsequent cases have been import-related. Based on the enormous success of this strategy in the Region of the Americas, supplementing routine measles vaccination with mass campaigns is now part of the recommended strategy of WHO and UNICEF for all developing countries.

Representatives from Haiti, Mexico, and PAHO's Immunization Unit presented the achievements of the Americas in measles mortality reduction at the global summit. Africa is currently applying lessons learned from the Americas to reduce measles mortality.

Partnerships

Long-term immunization planning is essential for achieving the immunization targets. This includes ensuring that measles activities are fully integrated with other national health goals, establishing high quality surveillance, mobilizing necessary human and financial resources, and planning for financial sustainability of measles mortality reduction activities.

One of the purposes of the Summit was to strengthen current partnerships and engage potential new partners for reducing measles mortality. Reducing measles deaths in a sustainable manner is the objective of the Measles Initiative, a broad-based partnership consisting of the American Red Cross, the Centers for Disease Control and Prevention (CDC), the UN Foundation, UNICEF, WHO, the Canadian International Development Agency (CIDA), governments, civil society and the private sector. In 2001 and 2002, the Measles Initiative delivered measles vaccine to over 70 million children in 16 African countries. Many additional partners were present at the Cape Town meeting. Their continued commitment will be critical to ensure the success of the international efforts to reduce measles mortality from 1999 levels by 50% by 2005.

Conclusion

The WHO/UNICEF Global Measles Summit in Cape Town was a landmark meeting for intensifying the commitment of global leaders to prevent one of the leading killers of children worldwide. International health experts urged countries and donors to take immediate action and to provide political and financial support to the global effort. Such commitment will be well received in the Region of the Americas whose countries have made great strides in controlling measles and are well aware of the risk of importation of measles back into the Region whenever circulation of measles virus exists in other regions of the world.

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Cape Town Measles Declaration, 17 October 2003

ALARMED that in 1999 alone an estimated 875,000 infants and children died from measles, and that measles continues to cause hundreds of thousands of child deaths each year, especially in developing countries;

STRESSING the importance of achieving the goals adopted by the United Nations General Assembly Special Session on Children in 2002 and the World Health Assembly in 2003 to reduce measles deaths by 50% compared with 1999 levels by the end of 2005, and the United Nations Millennium Declaration target to reduce the under-five child mortality rate by two-thirds by the year 2015 compared with 1990 levels;

RECOGNIZING that measles deaths are primarily due to lack of immunization with existing safe, effective and inexpensive measles vaccines and incomplete implementation of proven strategies;

NOTING the critical importance of continuing to strengthen routine immunization services, including the provision of a second opportunity for measles immunization, as the foundation of a comprehensive strategy to reduce measles deaths sustainably and the essential role of surveillance in monitoring and guiding measles control efforts;

HIGHLIGHTING the importance of developing multi-year immunization plans, the full integration of measles mortality reduction activities with other national health goals and mobilizing necessary human and financial resources for sustainable measles mortality reduction;

WELCOMING the remarkable progress that has been made by the Region of the Americas in interrupting measles virus circulation and the ongoing efforts in Africa, with strong support from the Measles Initiative to reduce measles deaths;

Those present at the Global Meeting for Sustainable Measles Mortality Reduction and Immunization Systems Strengthening declare our intent to:

SUPPORT the WHO/UNICEF Global Strategic Plan for Measles Mortality Reduction and Regional Elimination, 2001-2005 with special attention to increasing routine measles immunization coverage to at least 90 percent coverage in all countries, combined with providing all children with a 'second opportunity' for measles immunization either through the routine immunization schedule or periodic supplemental immunization activities;

WORK TOGETHER to identify the human and financial resources to strengthen immunization and health systems and to reduce measles deaths throughout the world;

ADVOCATE to strengthen immunization systems and reduce further measles mortality according to the strengths of each partner.

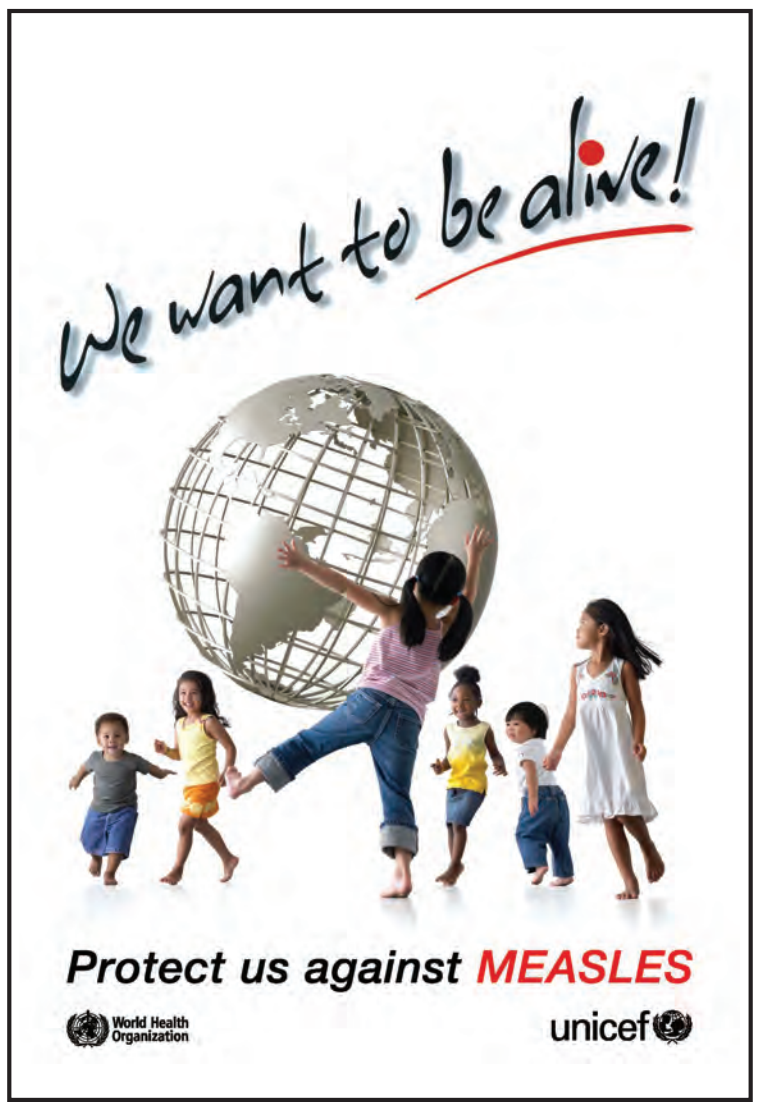
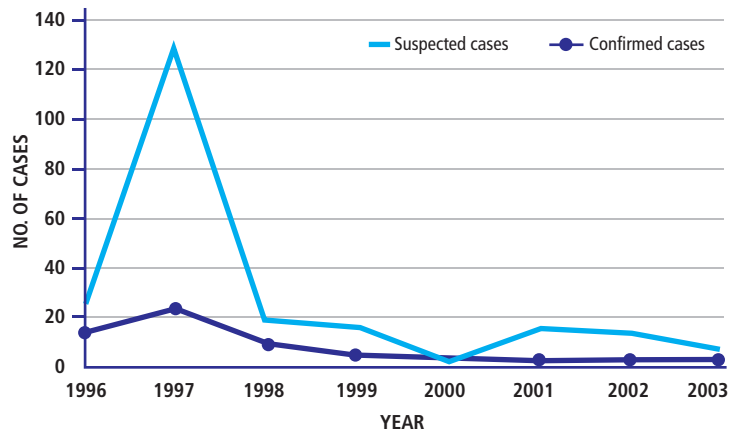
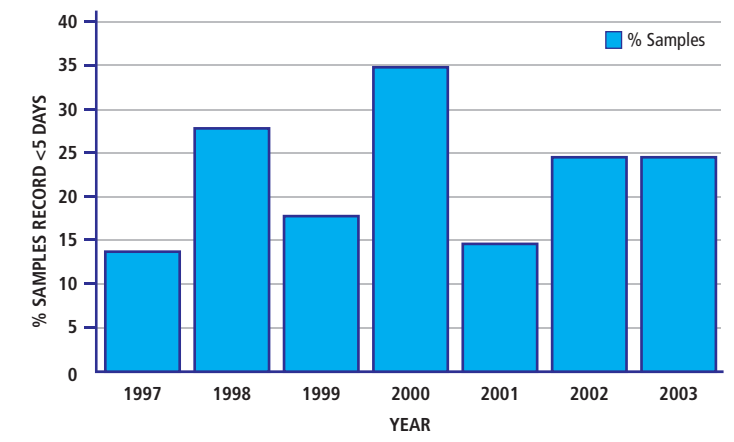


FIGURE 1 Reported suspected and confirmed cases of CRS, English-speaking Caribbean and Suriname, 1996-2003.*



*Week 43.
Source: MOH Reports to EPI-CAREC.

FIGURE 2 Percentage of samples received in CAREC Laboratory <5 days after being taken, English-speaking Caribbean and Suriname, 1997-2003.*



*Week 43.
Source: MOH Reports to EPI-CAREC.

December 2003
Volume XXV, Number 6

Caribbean EPI Managers' Meeting, 17–20 November 2003

The 20th Meeting of the Caribbean EPI Managers was held in Curaçao, Netherlands Antilles, from 17-20 November 2003. The meeting brought together over 60 health officials from 25 countries of the English-speaking Caribbean, Suriname, the Netherlands Antilles, Aruba, the French Departments of Guadeloupe, Martinique, and French Guiana, the United States and the US Virgin Islands, Canada, and the United Kingdom. Several Netherlands Antilles Representatives were present. PAHO Immunization staff and consultants, as well as staff from the Caribbean Epidemiology Center (CAREC) and the Caribbean Program Coordination Office (CPC) also attended.

Achievements in the Subregion

Control of vaccine-preventable diseases remains exemplary in the countries of the subregion, and all should be congratulated on their efforts. No measles cases were confirmed up to week 43 of 2003 despite careful surveillance, and there were no confirmed rubella cases for 2002 and 2003 to date (see Figure 1). The last case of CRS occurred in 1999 in Suriname.

More than 90% of the countries in the subregion are providing a two-dose MMR strategy. Those countries must measure coverage of each dose and calculate the number of children who have received two doses, one dose, or no doses of vaccine. Coverage for the second dose of MMR must be 95% or greater to prevent the accumulation of susceptible persons. If there are significant numbers of susceptible children who have not been protected by the second dose, then a further catch-up campaign must be conducted. For both measles and rubella, importation still remains the greatest risk for re-emergence.

Challenges

Integrated measles and rubella surveillance must be strengthened, especially for women who acquire rubella in pregnancy. The proportion of clinical specimens that were received within 5 days is still very low and must be improved (see Figure 2). If the first specimen is taken within the first three days of the appearance of rash in a pregnant woman or is collected from cases in clusters of fever/rash, and is negative by IgM testing, second specimens should be obtained.

Each specimen sent for measles and rubella IgM testing must have an epidemiologic case identification number. Evaluation reveals that some countries have no funding or mechanism in place for in-country transportation of specimens. Every effort is being made to encourage countries to ship specimens to the CAREC laboratory as quickly as possible and have in-country mechanisms for specimen transportation. Molecular typing of rubella virus isolates will facilitate better understanding of the source of rubella outbreaks, CRS cases, and rubella strain variations. To date, few virologic specimens are submitted for molecular typing. Countries embarking on rubella elimination must document strains to determine whether cases are indigenous or imported.

The IBIS system implemented in five countries –Barbados, Guyana, Jamaica, St. Vincent, and Trinidad and Tobago– requires additional technical support to be sustainable.

The immunization programs in the Caribbean are facing major challenges in achieving and sustaining high vaccination coverage in a climate of reform and economic difficulties in the health sector. In larger countries, overall immunization coverage needs to be increased. In addition, pockets of low immunization coverage exist in some countries. In addition, governments must ensure that invoices for vaccine supplies are paid in a timely fashion (i.e. within 60 days). Failure to pay for supplies jeopardizes maintenance of routine immunization and may lead to widespread rather than localized shortages.

Conclusions

Effective management and supervision of the implementation of EPI Plans of Action in each country remain the backbone of the Caribbean program. The EPI Managers participating in this meeting should be congratulated for their tireless efforts to reach all children and protect them from vaccine-preventable diseases. At the same time, governments must continue to keep immunization high on their list of priorities.

2004

April 2004
Volume XXVI, Number 2

Measles Elimination in Mexico

Background

The indigenous transmission of measles appears to have been interrupted in Mexico and the rest of the Americas since 2002.[1] However, 108 confirmed cases have been reported in Mexico since April 2003 and transmission is ongoing. Isolation of the virus and genetic sequencing have linked these cases with importations of H1 measles viruses from other parts of the world. Ongoing transmission in Mexico highlights the risk of importation of measles virus.

A PAHO mission was invited to visit Mexico from 19 to 23 April 2004. The objectives of the visit were 1) to evaluate the circulation of the measles virus in Mexico during the past 12 months; 2) to review the steps taken to interrupt transmission; and 3) to identify the lessons learned and the challenges for interrupting the transmission of the measles virus in Mexico.

This article presents the findings and the agreed-upon plan of action following the above-mentioned joint review of the measles situation in Mexico conducted by Mexican health authorities and the PAHO delegation.

Findings

1) Mexico has implemented the measles elimination strategies recommended by PAHO.[2]

In 1993, Mexico carried out a catch-up campaign to achieve the rapid interruption of measles transmission. Children under 14 years were targeted for measles vaccination and 96% coverage was achieved. In 1998 and 2002-2003, mop-up campaigns targeting children 1-4 years of age were carried out to protect susceptible preschoolers; these campaigns attained coverage levels of 95%.

Regarding routine vaccination to maintain measles elimination, official data on vaccination coverage indicated national coverage levels of 95% for children 1 year of age, 98% for children 2 years of age, and 99% for children under 5 for December 2003. This coverage has been maintained for the past four years. Rapid coverage monitoring in several states performed over a number of years using the WHO methodology[3] generally yielded similar or higher rates.

Similarly, the 2000 national measles seroprevalence survey of children aged 1 to 9 years (6,270 samples) conducted by Mexico's National Institute of Public Health found 99% seropositivity for measles (95% confidence interval: 98.8-99.3). There were no significant differences for gender or urban/rural environment. These data demonstrate good vaccination coverage achieved through the various vaccination strategies employed for measles elimination.

Mexico also has a sensitive surveillance system in place resulting in early case detection. The efficiency of the system has been recently reflected in the case investigations conducted in areas with measles cases in 2003-2004: the Federal District (DF) and the States of Mexico and Hidalgo. These investigations have been coordinated among the federal, state and local levels, with the participation of all health institutions. Specific activities have included:

- Clinical and epidemiological studies of the cases;
- Active case-finding, searching for cases in the area around the residence and places known to have had confirmed cases, as well as workplaces, child-care centers, street markets, and schools;
- Vaccination of the susceptible population and children aged 6-11 months;
- Retrospective case-finding in health units; and
- Rapid coverage monitoring.

2) 2003-2004 Measles Outbreak

The first known case in this outbreak appeared in Mexico City with date of onset of 13 April 2003. Between April 2003 and April 2004, 108 confirmed cases of measles, 44 in 2003 and 64 in 2004 (up to epidemiological week 16 of 2004), were reported to the Epidemiological Surveillance System for Exanthematous Febrile Diseases.

Of the 108 confirmed cases, 102 were confirmed by laboratory and 6 by epidemiological link. The source of infection could not be determined in 32 (31%) of them. Of the confirmed cases, 77 have occurred in the Federal District, 24 in the State of Mexico, 4 in the State of Hidalgo, 2 in the state of Coahuila and 1 in the state of Campeche. The most affected age groups are young adults and children under 1 year of age (Figure 1).

Measles serology testing has been performed at the Institute for Diagnosis and Epidemiological Reference (INDRE), Mexico's national epidemiological reference laboratory, and the Centers for Disease Control and Prevention (CDC) in the United States, using the ELISA test for the detection of measles IgM.

Furthermore, pharyngeal and urine samples have been tested for culture and polymerase chain reaction (PCR) assay in INDRE and in CDC. The past 12 months have yielded 13 positives with 100% homologous sequences corresponding to genotype H1, which were very similar to the H1 strain currently circulating in Japan. However, the source of importation has not been identified. Preliminary data indicate that three nucleotides of the virus differ from those of the H1 virus isolated from a case in Chile imported from Japan in 2003. The H1 genotype has recently surfaced in Korea and China, suggesting that this part of Asia was the source of the importation of the virus.

Mexico's National Health Security Committee declared a national emergency, which calls for assertive action to interrupt transmission. This Committee has agreed to:

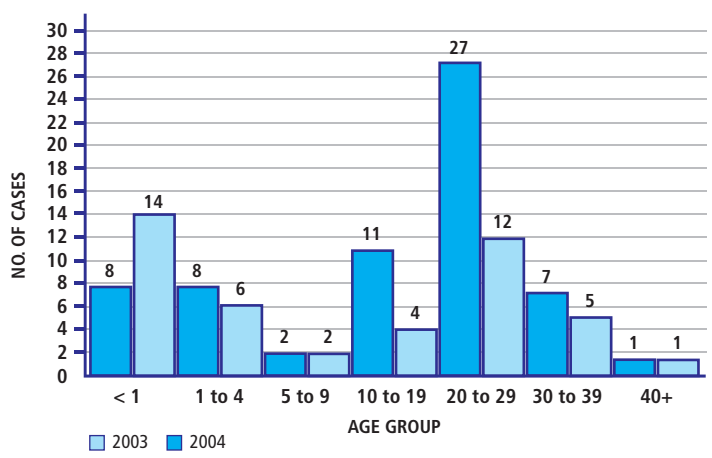
- Strengthen the Plan of Action for interrupting transmission.
- Eliminate circulation of the measles virus while moving forward with the program for eliminating rubella and congenital rubella syndrome through simultaneous and vigorous nationwide action.
- Procure and distribute 16.5 million doses of measles-rubella (MR) vaccine for administration to the susceptible population (aged 13 to 39 years).
- Distribute the general guidelines for immediate implementation of the respective Plan of Action in the states.
- Activate, without exception, the state Committees for Health Security, Epidemiological Surveillance (CEVE), and Vaccination (COEVA). They should meet on a continuous basis and will be in charge of timely monitoring the steps taken under the Plan of Action.
- At the federal level, hold monthly meetings so that CEVE and COEVA committees can report to their counterparts at the central level. The first meeting will be held from 13-14 May in Mexico City and will be attended by health services directors, program heads, and state epidemiologists.

Mexico's plan to interrupt measles transmission revolves around two elements:

a) Epidemiological surveillance:
- The CEVE committees should guarantee application of the epidemiological surveillance guidelines and their monitoring at the local level. They should also guarantee thorough inter-institutional coordination, the clinical and epidemiological investigations of each reported, case and the monitoring and supervision of surveillance and control activities in all units of the sector in the federative entities.

b) Vaccination activities for outbreak control:
- Immediate implementation of mop-up campaigns in high schools and professional schools throughout the country and vaccination of the population aged 13 to 39 years in all health units.
- Implementation of prevention and control measures when a case is reported through "blocking strategies" in high-risk areas (areas with cases and low coverage), by vaccinating the population aged 6 to 11 months and those aged 13 to 39 with no history of vaccination since 2000.
- Vaccination of health workers and tourism-sector employees with no history of vaccination since 2000.

FIGURE 1 Measles cases in Mexico by age group, from week 16, 2003 to week 16, 2004.



Source: Health Secretariat, Mexico.

Challenge

The current measles situation in Mexico poses a critical challenge for national authorities to maintain measles elimination in the Americas. As long as the measles virus continues to circulate in other parts of the world, the countries of the Hemisphere will be at risk for imported cases. The lessons learned in Mexico in stopping transmission will be important for other countries of the Region.

1 In accordance with the provisions of the Plan of Action for Measles Elimination in the Americas, adopted by PAHO's 38th Directing Council in September 1995 and the recommendations of the Technical Advisory Group (TAG) on Vaccine-Preventable Diseases.

2 Pan American Health Organization. Technical Paper No. 41: Measles Eradication Field Guide. 1999. Washington, D.C.

3 Pan American Health Organization. The Use of Rapid Coverage Monitoring: The Vaccination Campaign against Measles and Rubella in Ecuador. EPI Newsletter 2003; 25(2):1-3.

Strategies to Interrupt Transmission of the Measles Virus in Mexico

Given the existence of a national technical plan and the policy to interrupt measles transmission, the Mexican health authorities and the PAHO team agreed that the following general steps should be taken to bolster current efforts and ensure optimal implementation of the plan of action:

1. Mexico has made intensive efforts to control the outbreak in the affected municipalities. However, as recommended by the National Health Security Committee and the National Vaccination Board (CONAVA), it is important that intensive vaccination campaigns be waged to interrupt circulation of the measles virus.
   - The priority in these intensive campaigns is to vaccinate all adolescents and young adults aged 13 to 39 in Mexico with the MR vaccine. This is the group at highest risk, according to the epidemiological information on the measles cases and the national seroprevalence survey.
   - Vaccination activities should be carried out swiftly, preferably in a 4-6 week time span.
   - Given the time required for optimal planning of the campaign and the availability of all the necessary resources, September 2004 is suggested as the best time for ensuring successful implementation of this vaccination campaign. However, the group recognizes that transmission will continue and that there is significant risk of a rise in the number of cases and the spread of outbreaks to other parts of the country. In light of this, the group stresses the importance of establishing contingency plans and ensuring the immediate availability of the necessary resources, particularly the MR vaccine.
2. The success of the vaccination campaign hinges on a timely supply of the necessary resources. The target population consists of roughly 51 million individuals between the ages 13 and 39. A preliminary estimate based on previous years' vaccination activities in this age group and the purchase of 16 million doses of MR vaccine indicates that at least 26 million additional doses of MR vaccine are needed to conduct a vigorous, intensive countrywide vaccination campaign to interrupt transmission of the measles virus.
3. The global supply of vaccine is limited. In order to guarantee that producers have this number of doses on hand and can guarantee their availability, health authorities must inform the market of their needs as soon as possible.
4. It is important for the states and districts to draw up detailed plans of action that include the application of optimal modalities for vaccinating all young adults in the target age group.
5. To guarantee that the states make the commitment and carry out this plan in an optimal manner, the Health Secretariat will once more convey the decisions of the National Health Security Board to each state and draw up guidelines emphasizing the aspects described earlier.
6. To improve the detection, investigation, and classification of cases and contacts, the Health Secretariat will coordinate the review of all probable cases with acute febrile exanthema to the states and confirm all cases where there is evidence of an epidemiological link with clinically- or laboratory-confirmed cases.
7. To strengthen the national laboratory network, the Health Secretariat has made a commitment to take the following steps:
   - Train and strengthen state laboratories in the diagnosis of exanthematous febrile illnesses
   - Strengthen the role of the national reference laboratory (INDRE) in quality control, and performance evaluation in all laboratories of the national network.

August 2004
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Accumulation of Measles Susceptibles: The Experiences of the English-speaking Caribbean, Suriname, and Paraguay

PAHO's Strategy for Measles Elimination

In 1994, the countries of the Region of the Americas established the goal of measles elimination from the Western Hemisphere. Subsequently, significant progress has been achieved, mainly through the intensification of routine vaccination, mass vaccination campaigns, and enhanced surveillance.

The Pan American Health Organization (PAHO) recommended a three-pronged vaccination strategy. Its driving principle is to provide a second opportunity for measles vaccination, not only to children who did not seroconvert at the time of the first administration (primary vaccine failure), but most importantly, to vaccinate children who had never received any measles vaccination. To rapidly interrupt measles transmission, PAHO recommends a one-time nationwide campaign targeting children aged 9 months to 14 years ("catch-up"). After this campaign, the interruption of measles virus transmission is maintained by keeping high population immunity through routine vaccination of children aged >1 year ("keep-up"), and through periodic mass vaccination campaigns every 3-4 years ("follow-up") targeting children aged 1-4 years, regardless of their previous vaccination status.

To determine the interval between "follow-up" campaigns, the countries can calculate the accumulation of susceptibles based on vaccination coverage and the estimated vaccine failure. The next campaign should be scheduled when the number of children susceptible to measles in the population approximates the number of children in an average birth cohort. This article illustrates such calculations and the consequent decision-making process in the cases of the English-speaking Caribbean, Suriname, and Paraguay.

English-speaking Caribbean and Suriname

The Ministers of Health of the Caribbean Community (CARICOM) decided to eliminate measles from the sub-region in 1988. In 1991, all countries except Bermuda conducted "catch-up" campaigns. Since then, "follow-up" campaigns have been conducted by countries in 1995/1997 and 2000/2001. Routine use of a second dose of measles-containing vaccine has been implemented in most of the countries and/or territories.

All countries conducted mass vaccination campaigns between 1995 and 1997, except for Bermuda and the Cayman Islands. These two countries had introduced a second dose of measles-mumps-rubella (MMR) vaccine and considered the coverage of this second dose high; therefore, both countries concluded that a vaccination campaign was not necessary. The target population for the "follow-up" campaigns was children aged 1-5 years in nine countries. Bahamas and Suriname had a much wider age range, ages 4 to 40 and ages 1 to 39, respectively. Measles vaccination coverage ranged from 80% to 100% (Table 1).

Between 2000 and 2001, countries were scheduled to implement measles "follow-up" campaigns. However, eight countries were routinely administering two doses of MMR vaccine with the second dose given at 2 years or 4-5 years of age and attaining coverage levels over 84%. These countries decided to forgo a mass campaign with the commitment to target coverage for the second dose to be 90% or greater. For those countries that implemented the campaign, the target population was children aged 1-4 years. The coverage rate achieved in each country was >84%. Since 2001, routine annual vaccination coverage for the first dose of the measles-containing vaccine at country level has ranged between 90-100% for countries with a population <1 million inhabitants, while larger countries have had vaccination coverage levels ranging from 75 to 90% (Table 2).

Accumulation of Susceptibles

In 2000, the target population for the measles vaccine (children aged 12-23 months) was 133,237, of which 125,909 were vaccinated, giving an average measles coverage of 94.5%. Consequently, the number of unvaccinated children was 7,328. In calculating the accumulation of the measles susceptible population, vaccine effectiveness of 90% was assumed. For the year 2000, the number of measles susceptibles in all the CARICOM countries was 19,919 (Figure 1). The unvaccinated populations of children aged 12-23 months for 2001, 2002, and 2003 were 16,017, 16,391, and 20,517, respectively.

The estimated number of children susceptible for measles at the end of 2003 was 106,412, corresponding to 86% of a typical birth cohort (123,176 in 2003). The next "follow-up" campaign should be scheduled no later than 2005. However, all countries except Suriname are now routinely administering a second dose of a measles-containing vaccine, therefore "follow-up" campaigns will not be conducted in the countries. Only Suriname is scheduled to conduct a campaign in 2006. Nevertheless, health authorities have decided that if the percentage coverage for the second dose of measles vaccine is less than 90%, countries should consider "mop-up" vaccination efforts (intensive vaccination activities, such as door-to-door vaccination, to reach underserved population segments). This will ensure coverage for the second dose will be >95% in children aged 1-4 years or in the age group targeted for the second dose in each country. Countries such as Jamaica, Barbados, and Guyana will have to plan and implement intensive vaccination activities to attain this goal.

Paraguay

Paraguay conducted its "catch-up" campaign in 1995, reaching 70% coverage. Its last confirmed measles case occurred in November 1998. Since 2002, routine measles vaccination using monovalent measles vaccine was replaced with one dose of MMR vaccine, administered to children aged 12 months. Thereafter, the average coverage rate through routine immunization has been 88.5%. Additionally, "follow-up" campaigns were conducted in 1998 and in 2003.

The 2003 campaign used measles-rubella (MR) vaccine and targeted children aged 1 to 4 years. Of the targeted 594,846 children, 551,933 (93%) were vaccinated. The regions that did not reach the goal of 95% coverage were identified (Concepción, San Pedro, Guairá, Caazapá, Itapúa, Paraguary, Alto Paraná y Ñeembucú) as part of "mop-up" efforts to vaccinate 42,913 children who had not been vaccinated. Rapid coverage surveys[2] to identify pockets of unvaccinated children were conducted in districts and areas served by health services reaching <95% of the target population. Efforts to vaccinate all children in neighborhoods with poor vaccination rates were then implemented.

Accumulation of Susceptibles

For 2003, 135,607 (91%) of the 148,399 children targeted were vaccinated (Table 3). Assuming a conservative estimate of 90% vaccine effectiveness, the number of one-year-old children who were susceptibles at the end of 2003 –as either the consequence of primary vaccine failure or failure to receive vaccination–was 26,353. This figure represents 18% of a typical birth cohort. Similar calculation is made for 2004,

TABLE 1. Measles "follow-up" campaigns in the English-speaking Caribbean and Suriname, 1995-1997.

Country	Year of campaign	Target pop.	Age range	% Pop. vaccinated	Vaccine used
Anguilla	1996	1,097	1-15 years	100	MMR
Antigua	1996	6,208	1-2 years	92	Measles
Bahamas	1997	100,000	4-40 years	80	MMR
Barbados	1996	19,054	1-5 years		Measles
Bermuda	No Campaign				
Belize	1995	25,258	1-5 years	85	Measles
British V.I.	1996	292	4-15 years	90	MR/MMR
Cayman Is.	No Campaign				
Dominica	1996		2-10 years	≈100	MMR
Grenada	1996	10,620	1-5 years	81	MMR
Guyana	1996	84,839	1-5 years	90	MMR
Jamaica	1995-6	497,009	1-10 years	95	MMR
Montserrat	1996	735	4-10 years	100	MMR
St. Kitts	1996	3,060	1-5 years	100	MMR
St. Lucia	1996	9,000	2-5 years	85	Measles
St. Vincent	1995	10,860	1-4 years	84	MMR
Suriname	1997	45,000	1-6 years*	98	MMR
Trinidad and Tobago	1997	120,000	1-6 years	96	MMR
Turks and Caicos Is.	1996	1,040	1-5 years	95	MMR

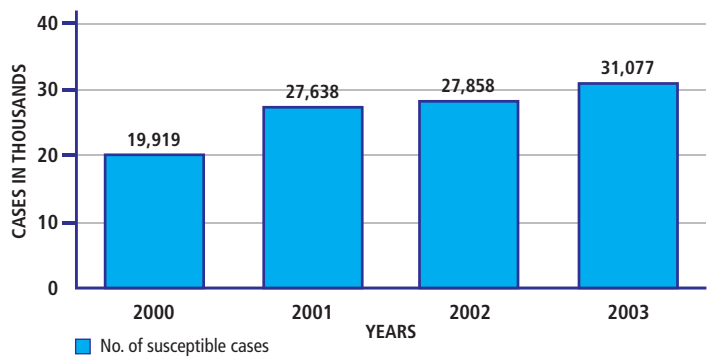
*Only data for children aged 1-6 years are presented.

TABLE 2. Measles vaccination activities in the English-speaking Caribbean and Suriname.

Country	Campaign 9 mo. – 14 yrs. Year	Campaign 9 mo. – 14 yrs. Coverage %	Average routine coverage 2001–2003 (Keep-up)	2000–2001 campaign 1–4 yrs. (Follow-up) Year	2000–2001 campaign 1–4 yrs. (Follow-up) Coverage %	Next follow-up due (Year)
Anguilla	1991	99	97	2000	95*	2004
Antigua	1991	96	99	2000	90*	2004
Bahamas	1991	87	93	2001	Not available	2005
Barbados	1991	96	91	2001	50* a	2005
Bermuda[b]	Not done		76	Not available		–
Belize	1991	82	86	2000	95	2004
British Virgin Is.	1991	88	100	2000	95*	2004
Cayman Is.	1991	85	87	Routine 2nd. dose = 90%		–
Dominica	1991	95	99	2000	99	2004
Grenada	1991	98	98	2000	88	2004
Guyana	1991	94	91	2000	84	2004
Jamaica	1991	71	83	2000	94	2004
Montserrat	1991	100	96	2000	99*	2004
St. Kitts	1991	98	98	2000	99	2004
St. Lucia	1991	97	93	2000	89	2004
St. Vincent	1991	97	97	2000	89*	2004
Suriname	1991	89	75	2000/1	90	2006
Trinidad and Tobago	1991	90	89	2001	96*	2005
Turks and Caicos	1991	81	92	2000	84*	2004

*For countries not conducting follow-up campaigns, coverage is calculated for routine 2nd dose.
a Last data available. In Barbados, the 2nd dose was initially given at 10 yrs, but this was changed to 4-5 yrs. in 2000.
b Bermuda started using MMR vaccine in the 1970's and did not conduct a catch-up campaign.

FIGURE 1 Accumulation of measles susceptibles, English-speaking Caribbean and Suriname, 2000–2003.



Source: Ministry of Health reports to EPI/CAREC.

TABLE 3. Accumulation of susceptibles in Paraguay, 2003-2007.

Population groups		2003	2004*	End 2005	End 2006	End 2007
Population aged 1 year**	= A	148,399	148,399			
Vaccinated children		135,607 (91%)	130,591 (88%)			
Unvaccinated children	= B	12,792	17,808			
Susceptible children due to vaccine failure***	= C	13,561	13,059			
Total susceptibles per year (B+C)	= D	26,353	30,867			
% susceptibles per year (D/Ax100)		18%	21%	19%	19%	19%
Cumulative % of susceptibles		18%	39%	58%	77%	96%

* Projected from coverage data up to June 2004.
** Data for 2003-2004 from National Office of Statistics and Census, Ministry of Public Health and Social Welfare.
*** Assuming primary vaccine failure of 10%.

assuming a target population of 148,399 children aged 1 year and vaccination coverage of 88% (projection based on 65,094 vaccinated children as of July 2004). It is estimated that 30,867 one-year-old children will join the pool of susceptibles at the end of 2004. Adding the number of susceptibles for 2003 and 2004, the pool of susceptible children at the end of 2004 is estimated to be 39% of a typical birth cohort (Table 3). If the same pattern were to be observed in 2005 and 2006, i.e., an average of 19% of the birth cohort remaining susceptible each year, 77% of a typical birth cohort would be susceptible at the end of 2006 and 96% at the end of 2007. Using 95% vaccine effectiveness, an average 15% of a birth cohort would be accumulating each year. At the end of 2007, the number of susceptible children would be equivalent to 80% of a typical birth cohort.

Based on these results, Paraguay has scheduled its next "follow-up" campaign for 2007. However, as part of the rubella elimination initiative, a mass vaccination campaign targeting the population aged 5-39 years and using MR vaccine is planned for 2005. This campaign will not only greatly reduce rubella virus transmission, it will also greatly reduce the risk of measles virus transmission following potential importations.

References

1 Anguilla, Antigua, Barbados, British Virgin Islands, Montserrat, St. Vincent, Trinidad and Tobago, Turks and Caicos.

2 Pan American Health Organization. The Use of Rapid Coverage Monitoring: The Vaccination Campaign against Measles and Rubella in Ecuador. EPI Newsletter 2003; 25(2):1-3.

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Volume XXVI, Number 6

XVI Meeting of the PAHO Technical Advisory Group on Vaccine-preventable Diseases: Conclusions and Recommendations

The XVI Meeting of PAHO's Technical Advisory Group (TAG) on Vaccine-preventable Diseases was held 3-5 November 2004 in Mexico City, Mexico. TAG meets every two years and functions as the principal forum for providing advice to PAHO Member States on vaccine policies and disease control efforts. The following is a summary of TAG's technical deliberations and recommendations as presented in the Final Report regarding measles.

Since the last TAG meeting, held in Washington, D.C. in November 2002, the immunization programs of the Region of the Americas have maintained the continent free of indigenous wild poliovirus transmission, have interrupted endemic transmission of indigenous measles virus, and have made great strides toward the goal of eliminating rubella and congenital rubella syndrome (CRS). Over the years, vaccination has saved millions of children and has contributed to a decrease in childhood mortality in the Americas; for the period 1990-1995, there were 51.4 deaths per 1,000 live births, and by 2003 the mortality rate had dropped to 30.7.

TAG acknowledged the remarkable progress achieved by PAHO's Immunization Unit over the last two years in coordinating technical support to Member States. Activities have included advancing the Directing Council Resolution CD44.R1 in September 2003 for rubella and CRS elimination, organizing ad-hoc expert group meetings on rubella and measles, convening regional and global rotavirus meetings, assisting in the development of country and regional Plans of Action, conducting three country evaluations, organizing and supporting the Vaccination Week in the Americas, and advising on numerous country-based surveillance activities.

Measles

In the 10 years since the goal of measles elimination was adopted, measles incidence has decreased by more than 99% in the Americas. The Venezuelan outbreak in 2002 can be viewed as the last instance of widespread endemic transmission of the measles virus in the Americas. However, the recent outbreak in Mexico encourages all countries in the Region to improve immunization coverage and surveillance as the best protection against importations.

Recommendations

Recognizing that endemic measles virus transmission has likely been interrupted in the Americas, TAG reaffirms the need for a continued commitment of health authorities and workers toward sustaining past achievements.

- To avoid outbreaks, coverage rates with measles-containing vaccine must be maintained at >95% in all municipalities. Improving coverage with the first dose may be accomplished through implementation of specific strategies in high-risk districts. High-quality nationwide follow-up campaigns should also be conducted every 3 to 4 years in order to maintain population immunity. Additionally, supplemental immunization activities should target low-coverage municipalities and under-served or hard-to-reach population groups.
- To harmonize practices among countries, TAG endorses the definitions of elimination, re-establishment of endemic transmission and imported/import-related cases recommended by the Meeting of the Ad-hoc Panel of Experts in Rubella and Measles held in Washington, D.C. in March 2004.
- To guarantee transparency and foster mutual trust, TAG encourages countries to share with PAHO's Immunization Unit information on all aspects of their immunization programs. Such information includes, but is not limited to, case-based surveillance, laboratory data, and vaccine coverage data.
- Three surveillance indicators are particularly critical: proportion of suspected measles cases with an adequate investigation, proportion of suspected cases with an adequate blood sample, and proportion of transmission chains with representative samples for viral isolation.
- An indicator for rate of febrile eruptive illnesses investigated should be established, based on the experience in the countries.
- PAHO should review logistical and other issues which are barriers to submitting samples in a timely fashion.
- The TAG recognizes the work of the Secretariat in updating the Measles Field Guide, as well as field guides for polio, rubella and other vaccine-preventable diseases, in 2004. The TAG encourages the use of these guides in training and updating the skills of health personnel.
- An ad-hoc group should be established to review past experience and to identify best practices in measles surveillance and vaccination.

2005

August 2005
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XVIII Meeting on Vaccine-preventable Diseases of the Central American Region, Mexico, and the Latin Caribbean

The XVIII Meeting on Vaccine-preventable Diseases of the Central American Region, Mexico and the Latin Caribbean was held in Antigua, Guatemala, on 6-7 June 2005. The meeting's main objectives were as follows:

- To review the current situation of each country and progress toward eliminating measles, rubella, and congenital rubella syndrome (CRS);
- To discuss the surveillance of acute flaccid paralysis (AFP), pertussis, diphtheria; and neonatal tetanus (NNT); and
- To analyze the status and prospects for introducing the influenza vaccine and new vaccines.

Measles, Rubella, and CRS

In 2003 and 2004, approximately 100 measles cases were reported each year in the Americas, most of them directly or indirectly linked to importations. Mexico's recent experience with measles virus transmission should serve as an incentive to all the countries in the subregion to improve vaccination coverage and surveillance as the best way of protecting against imported infections. High-level measles vaccine coverage, reliable detection, and aggressive follow-up of suspected cases will limit the consequences of measles virus importations.

The incidence of rubella has decreased by 98%, dropping from 135,000 reported cases in 1998 to 3,103 cases in 2004. All countries are strengthening the integration of measles and rubella surveillance. Improvements must be made in the adequate investigation of suspected cases. Three quarters (9/12) of the countries in the Subregion are reporting suspected CRS cases every week. CRS surveillance needs to be urgently strengthened.

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XIV Meeting of the Andean Region and XVII Meeting of the Southern Cone on Vaccine-Preventable Diseases

The XIV Meeting of the Andean Region and the XVII Meeting of the Southern Cone on Vaccine-preventable Diseases were held in Asunción, Paraguay, from 25-26 October 2005. In unprecedented fashion, the President of Paraguay, Dr. Nicanor Duarte Frutos, attended the meeting. Dr. Jon Andrus, Chief, Immunization Unit at PAHO Headquarters, handed him a certificate of appreciation to recognize Paraguay's achievements during the rubella campaign the country conducted in April and May 2005. In his address, President Duarte thanked each member of the team who made the campaign a success. He indicated that public health is a priority in Paraguay, as it represents a means to achieving social development, prosperity, and peace. He stressed that increasing the health budget is necessary, but that better spending and innovation are also critical. President Duarte added that health workers had written a new chapter in Paraguay's history and helped with improving the life of its people.

Delegations from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela participated in the meeting. Paraguay also invited health workers from all levels of its health care system. Representatives of the Ministry of Education, the Social Security scheme, UNICEF, the Center for Population Studies, the Inter-American Development Bank, Plan Internacional, and the Paraguayan Red Cross also attended the meeting.

Dr. Carmen Serrano, PAHO Representative in Paraguay, welcomed the participants. Dr. Andrus highlighted the information guiding countries in their efforts to prioritize the unfinished agenda in immunization. Dr. Roberto Dullack, Vice-Minister of Public Health and Social Welfare of Paraguay, inaugurated the meeting and emphasized the Pan-Americanism of the Immunization Program. Dr. Maria Teresa León Mendaro, Minister of Health of Paraguay, presented the results and lessons learned from the vaccination campaign for the elimination of rubella and congenital rubella syndrome (CRS) conducted in Paraguay in 2005.

Measles

In South America, three cases of measles were reported in 2003 (two in Brazil, one in Chile), none in 2004, and six in 2005 (all part of one outbreak in Brazil). All these cases were imported or related to importation; the majority of the patients had not been vaccinated against measles.

Experience indicates that, when a high and uniform coverage is achieved with measles vaccine, the reliable detection and aggressive monitoring of suspect cases will limit the impact of measles virus importations. All countries of the sub-region but one have reported measles coverage >90% in 2003 and 2004. Venezuela reported coverage of 82% in 2003 and 80% in 2004. Furthermore, six countries—Argentina, Brazil, Chile, Colombia, Paraguay, and Uruguay— recommend a second dose of measles vaccine in their national schedule. Paraguay and Uruguay (2003), Brazil (2004), and Argentina (2005) have conducted follow-up campaigns in order to limit the accumulation of susceptibles. Chile will conduct a follow-up campaign starting in November 2005. The greater accumulation of measles susceptibles occurs in Venezuela, where the last follow-up campaign took place in 2001. A campaign planned by 2005 has been postponed to 2006. In spite of high overall measles coverage levels, significant pockets of susceptibles exist in South America. According to 2004 data (or 2003 data if 2004 data are not available), measles coverage in 48% of municipalities was <95%. The proportion of municipalities with coverage <80% is particularly significant in Colombia (57%), Venezuela (55%), and Bolivia (53%), although it is possible that some of these results reflect denominator problems.

All the countries have achieved a good integration of measles and rubella surveillance. However, challenges remain regarding reaching some surveillance indicators, and solutions need to be tailored to the situation of each country. A high level of inter-country coordination is critical for the success of integrated surveillance in border areas.

Recommendations

- Countries should continue monitoring the accumulation of measles susceptibles. Countries recommending a second dose of measles vaccine in the routine vaccination schedule should systematically collect coverage data. A follow-up campaign continues to be necessary each time evidence exists of an accumulation of susceptibles.
- Countries should strengthen their efforts to reach measles vaccine coverage >95% in all municipalities. Municipalities at risk should be identified and plans of action developed and implemented to improve coverage.
- Remote or marginalized population groups in need of supplementary immunization activities, for example in the context of the VWA, need to be identified.
- Active epidemiological surveillance of measles/rubella should take place in all municipalities, including active case-finding in high-risk municipalities and in silent areas. Furthermore, rapid epidemiological investigation (before the availability of serology results), including obtaining representative samples for viral detection, should be ensured.
- Countries should reevaluate the fulfillment of the measles/rubella integrated surveillance indicators. They should take measures to guarantee adequate surveillance, such as implementation of new means of collection of blood samples (filter paper) and use of buccal swabs, and consider new solutions.
- Plans to respond to importations should be in place, ensuring that a responsible team and available funds can be liberated rapidly.

2006

February 2006
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2005 Caribbean EPI Managers' Meeting

The 22nd Meeting of the Caribbean EPI Managers was held in Bermuda, from 29 November to 2 December 2005. The meeting brought together over 70 health officials from 24 countries of the English-speaking Caribbean, Aruba, Canada, the Netherland Antilles (Bonaire, Curaçao, Saba, St. Eustatius, and St. Martin), Suriname, and the United Kingdom. PAHO Immunization staff, representatives from the Caribbean Epidemiology Center (CAREC), the Caribbean Program Coordination Office, the Caribbean Community (CARICOM), the Christian Children's Fund, and UNICEF also attended.

Measles and Rubella Elimination

The last case of indigenous measles in the Caribbean Community was reported in 1991, and the last importation (from a European tourist), in 1998. Experience in several countries shows that, when high coverage with measles-containing vaccine exists, reliable detection and aggressive follow-up of suspect cases will limit the consequences of measles virus importations.

Rubella vaccination campaigns have been highly successful in the Caribbean. There has been no laboratory confirmed rubella case since 2001. No confirmed rubella cases were reported between 2002 and 2005. In 2005 (Week 43), 3 congenital rubella syndrome (CRS) suspect cases were referred for testing and 41 other for TORCH[1] studies. All were laboratory-investigated for rubella; all were negative. The last CRS case in the Caribbean was reported in 1999.

Surveillance remains a critical tool to ensure interruption of transmission. In order to achieve timely, complete, and accurate information from surveillance systems, countries are expected to report from both public and private sector sites. There were 735 reporting sites in the countries of the Sub-region in 2005. In 2005 (Week 43), 99% of sites reported weekly, 99% of cases were investigated within 48 hours, 97% of cases had adequate samples taken, and 95% received laboratory results in less than 4 days. The percentage of cases discarded by laboratory testing was 99%.

The percentage of samples reaching the laboratory in less than five days has remained under 50%. For example, in 2000 only 35% of specimens arrived at the regional laboratory in less than 5 days. In 2001, 2003, and 2004, the rate was 15%, 23%, and 29%, respectively. In 2005 (Week 43), 31% of specimens arrived at the regional laboratory in less than 5 days of blood collection. Every effort is being made to encourage countries to ship specimens to the CAREC laboratory as quickly as possible and have in-country mechanisms for specimen transportation.

Reference
1. Toxoplasma gandii, others, rubella, cytomegalovirus, and herpex simplex.

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Classification of Suspect Measles/ Rubella Cases as "Vaccine-related:" Compliance with PAHO Recommendations

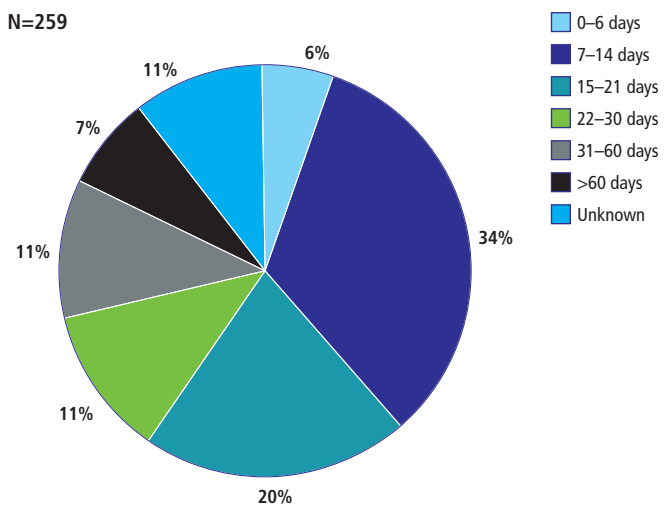
Background

In a setting of low or absent transmission of the measles/rubella virus, surveillance will detect patients with eruptive febrile illnesses who have positive serological results for measles or rubella but no wild-type measles/rubella virus infection.[1] One explanation for such occurrence is a reaction to the measles-mumps-rubella vaccine (MMR). In 2000, the PAHO Technical Advisory Group on Vaccine-preventable Diseases defined five criteria for concluding that a rash-illness is related to a measles/rubella-containing vaccine.[2]

A case can be classified as having a vaccine-related rash if it meets ALL of the following criteria:

1. Presence of rash illness, with or without fever, but no cough or other respiratory symptoms related to the rash;
2. Rash onset began 7–14 days after vaccination with a measles-containing vaccine;
3. Serum sample, taken between 8 and 56 days after vaccination, is positive for measles;

FIGURE 1 Days between vaccination and rash onset in MESS cases classified as "vaccine-related," 2003–2005.*



* Preliminary data as of week 10, 2006.
Source: Measles Elimination Surveillance System (MESS).

4. Thorough field investigation did not identify the index case or any secondary cases; and
5. Field and laboratory investigation failed to identify other causes (including failure to identify wild measles virus in culture).

As part of periodic data quality reviews of the Measles Elimination Surveillance System (MESS), the compliance of cases classified as vaccine-related has been checked against the criterion defining the acceptable time period between vaccination and rash onset (criterion 2). The MESS database included a total of 38,894 suspect measles/rubella cases with rash onset between 2003-2005 (as of epidemiological week 9, 2006). Of those cases, 259 (0.67%) were classified as vaccine-related. Figure 1 shows the distribution of cases classified as vaccine-related by the number of days between vaccination and rash onset. For the years 2003–2005, only 34% of the cases classified as "vaccine-related" met the criterion of rash onset 7–14 days following MMR vaccination.

To prove whether evidence existed supporting the onset of MMR-related rash beyond the 7–14 day period following vaccination, a literature review and discussions with experts were conducted. This process showed overwhelming evidence of MMR-related rash occurring specifically between 7 and 14 days following vaccination.

Two placebo-controlled clinical trials[3,4] are the main basis for defining the 7-14 day period. In these studies, the authors followed groups of MMR vaccinees after injection and found that the peak period for vaccine-related rash onset was during the second week after vaccination. Additionally, several other prospective studies and case reports reached the same conclusion.

A few studies report cases of rash occurring beyond 14 days after MMR vaccination, but such cases are the exception rather than the rule. Importantly, these studies were not placebo-controlled. The above-mentioned placebo-controlled clinical trials showed that the proportion of rash cases beyond the second week after MMR vaccination was not significantly different between the group receiving MMR and the placebo group.[3,4] This finding suggests that rash seen in MMR vaccinees 14 days or later after MMR vaccination is not likely related to the vaccine.

For those MESS cases classified as vaccine-related but with rash onset beyond 7–14 days following vaccination, the etiology is likely to be other rash-illnesses that typically occur in the pediatric population, such as parvovirus B19 and human herpes virus 6, or could represent missed cases of measles or rubella. The "vaccine-related" MESS cases are being evaluated to determine if this may be the case. The Immunization Unit recommends that countries review the definition of a vaccine-related case as recommended by PAHO and classify potential vaccine-related cases accordingly.

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April 2006
Volume XXVIII, Number 2

Measles Outbreak Reported in Venezuela

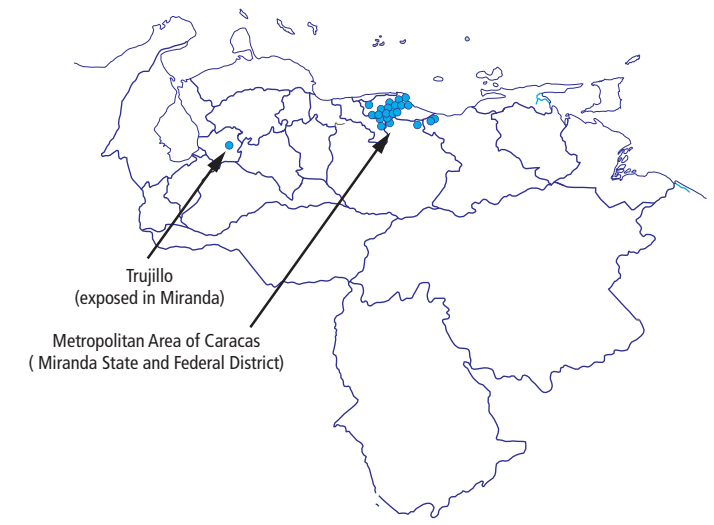
The outbreak of >2,500 confirmed measles cases that occurred between September 2001 and November 2002 in Venezuela was the last occurrence of widespread measles circulation in the Americas. In early March 2006, the Venezuelan Ministry of Health detected a measles importation that as of 6 April has resulted in the confirmation of 23 cases. All cases but one were residents of the State of Miranda (n=20) and the Federal District (n=2), specifically of the metropolitan area of Caracas (Figure 1). The remaining case occurred in the State of Trujillo, but had been exposed in the State of Miranda.

The index and primary case of this outbreak was a Venezuelan man, aged 33 years and unvaccinated, who traveled for leisure to Madrid, Spain, and Paris, France, on 1-13 February 2006. On 17 February, he developed a febrile illness, which was first self-medicated and two days later diagnosed as bronchitis at a first hospital (Hospital A). Seeing no improvements, the patient attended a second hospital (Hospital B) the evening of 22 February. He was in the emergency room of this hospital for over 12 hours before a rash developed on 23 February, when measles was suspected and the patient put on respiratory isolation. Measles was confirmed by serology (IgM EIA); virus isolation was successful and sequencing is pending as of April.

Investigation detected nine cases of first generation of transmission and 13 of second generation. All cases of first generation were likely exposed in Hospital B on 22-23 February, eight of nine in the emergency room. Eight of 13 cases of second generation were likely exposed in the emergency room of Hospital B on 6–7 March to a case of first generation returning for care to this hospital; one case was likely exposed at Hospital B on 7–9 March but not in the emergency room; three cases are family members of a first generation case; epidemiological link of one case is unknown. Figure 2 shows the age distribution of all confirmed cases. No case had a documented history of measles vaccination.

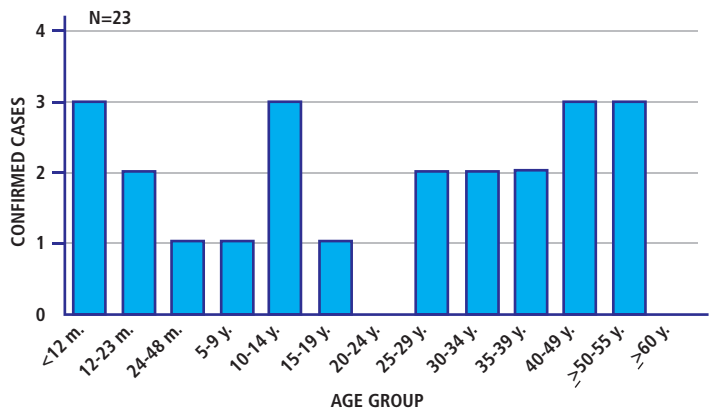
The Venezuelan Ministry of Health responded with a comprehensive plan to control this outbreak. Measles surveillance was enhanced country-wide, and active case-searches were initiated in private health facilities of the metropolitan area of Caracas. In the emergency room of Hospital B and other health facilities considered at risk of receiving measles cases in their prodromal stages, measures were implemented to limit access to patients, to vaccinate anybody entering the facility (including any patient without contraindications to vaccination), to separate the flow of patients with fever and to triage them based on risk factors (visit to emergency room or contact with person with rash in previous 4 weeks), and to take respiratory precautions for all suspect patients. Case investigation included ring vaccination targeting people aged 6 months to 39 years and active case-searches. Finally, Vaccination Week in the Americas took place earlier than anticipated on 9 April, with the target to vaccinate all children aged 6 months to 4 years and any susceptible child or adolescent aged 5–17 years. In the State of Miranda and the Federal District, 1.8 million people were vaccinated by 10 April. A nation-wide campaign to vaccinate all adults aged 18–39 years is being prepared for September 2006.

FIGURE 1 Geographical diistribution of confirmed measles cases, Venezuela, February–April 2006.*



* As of 6 April 2006 (N = 23).
Source: Ministry of Health, Venezuela.

FIGURE 2 Age distribution of confirmed measles cases, Venezuela, February–April 2006.*



* As of 5 April 2006 (N = 23).
Source: Ministry of Health, Venezuela.

The origin of this outbreak is most likely a measles outbreak in Madrid, Spain, that has resulted in 59 cases reported between mid-January and mid-March. The Venezuelan situation clearly illustrates the constant risk of measles importations to which any country in the Americas is exposed. Besides maintaining high and homogenous vaccine coverage, surveillance is critical for the early detection and control of importations. Private health hospitals and practices must be included in this surveillance system.

June 2006
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Measles Virus Importations: A Constant Threat to Measles Elimination in the Americas

In 1994, countries of WHO Region of the Americas were the first to commit to measles elimination. Transmission of the D6 measles virus genotype—which began in 1995 and caused large outbreaks in Argentina, Bolivia, Brazil, the Dominican Republic, and Haiti—was interrupted in September 2001. The subsequent transmission of the D9 measles virus genotype in Venezuela was interrupted in November 2002, 14 months after it had started. The Venezuelan outbreak can be viewed as the last instance of widespread endemic transmission of the measles virus in the Americas.

Between 2003 and 2005, only a hundred measles cases have been reported each year in the Region (2003, 119 cases; 2004, 108; 2005, 84), which represent a cumulative annual incidence of approximately 0.1 case per million population. Epidemiological investigation can positively trace the majority of the cases now occurring in the Americas to importations from other continents.

While a few countries outside the Americas have also interrupted measles virus circulation, measles remains endemic in all other continents. An estimated 20–30 million measles cases still occur each year worldwide. With an estimated 454,000 deaths in children aged <5 years in 2004, measles is still the leading vaccine-preventable cause of childhood mortality.[1] Sub-Sahara Africa and South Asia account for 92% of these deaths. While Africa and South Asia pursue mortality control goals, the three remaining WHO Regions—Eastern Mediterranean, Europe, and Western Pacific—now have elimination goals similar to that of the Americas.

In recent months, an increase in reports of measles outbreaks has occurred in Europe (Table 1). This increase is likely due to both improved surveillance and increased measles activity in that Region. Since, in 2000,

two thirds of the 33.7 million tourists visiting the Americas from other Regions were from Europe,[2] this year's occurrence of large outbreaks in Europe might indicate an increased risk of measles virus importation to the Americas. Measles virus importations from Asia are also detected regularly in the United States and sporadically in Latin America. The flux of passengers from Asian countries to Latin America and the Caribbean is much smaller than to the United States.

In this article, we review three measles outbreaks that have been detected in the Americas since December 2005. These outbreaks might ultimately have originated from three different continents: Africa, Europe, and Asia. However, all three outbreaks highlight the importance of vaccinating risk groups, especially workers in the health care, transportation, and tourism sectors; including private health care facilities in the integrated measles/ rubella surveillance network; carefully managing nosocomial outbreaks; and obtaining proof of measles immunity from residents of the Americas traveling to other continents.

Mexico, December 2005–February 2006

Between 12 December 2005 and 17 February 2006, 27 measles cases were confirmed in Mexico (Figure 1). Case-patients were either children aged <2 years or young adults. All cases but one (a 19-year-old man who had received one dose of measles vaccine when aged 1 year) were not vaccinated (Figure 2). All case-patients lived in the metropolitan area of Mexico City. Investigation detected five transmission chains, all starting in workers of the international airport of Mexico City. The index case of the outbreak was a 28-year-old man employed as a baggage handler (in the international baggage claim area) who had rash onset on 12 December 2005. A second transmission chain originated in a 33-year-old woman, employed as a ticketing agent and who had rash onset on 20 December 2005. The three remaining transmission chains relate to construction workers temporarily employed at the airport, where extensive construction work occurred in 2005.

None of the 27 confirmed cases had a history of travel outside of Mexico during the 7–21 days prior to rash onset. However, measles virus of genotype B3 was isolated in several case patients, including the index patient. Molecular analyses have shown that the isolated virus has a common source with viruses isolated from six other measles patients reported in North America, or with travel history to the area in November–December 2005. The case with the earliest known illness was a 17-year-old refugee who arrived from Kenya to New Jersey, USA, on 9 November 2005 having symptoms consistent with measles. The sequence of the virus isolated in this patient was identical to the sequences from viruses collected from measles cases in Nairobi, Kenya, earlier in 2005. The epidemiological link among the different clusters of cases could not be established.

Vaccination of risk groups, including airport personnel, was an important lesson from the 2003–2004 outbreak in Mexico. However, the extensive personnel turnover and the presence of construction workers made it difficult to assure full compliance with this requirement. The index case-patient, for instance, had only started working at the airport in July 2005.

Venezuela, February 2006–Ongoing

Preliminary information on this outbreak was presented in the last issue of the Immunization Newsletter.[3] Following the occurrence of an imported case (a 33-year-old unvaccinated man who had traveled to Spain and France for leisure), 44 other cases were reported in the metropolitan area of Caracas. Including the imported case, rash onset dates extended from 23 February to 3 May 2006. The majority of the cases were exposed in the emergency room of a private clinic. Triage and isolation of febrile patients with a risk profile (visit to an emergency rooms or contact with persons with rash during previous four weeks), as well as vaccination of all patients and visitors without contraindication, were the two main measures implemented to prevent measles virus transmission in Caracas' private clinics.

Two additional outbreaks were identified. The first occurred in the Isla Margarita, Nueva Esparta, a popular tourist destination 350 km north-east of Caracas. The four cases had rash onset between 19 and 27 March 2006. The patients lived in different municipalities of the island, but all visited a recently opened public hospital on 9 March. A source case could not be identified. A second outbreak occurred in the State of Carabobo, 120 km south-west of Caracas. As of the end of June, 16 cases were reported. They had rash onset on 16–28 May 2006 and are all part of a local church with over 5,000 members. No epidemiological link between these two outbreaks and cases in the metropolitan area of Caracas could be established to date. Case patients in Venezuela were of all age groups. While viral isolation from specimens collected from several patients (including the imported case) was successful, the determination of viral genotypes is still pending. Once the molecular sequencing of the isolates is available, it will provide important clues not only on the origin of the Caracas' outbreak, but also on potential ties with the two further outbreaks.

United States, May–June 2006

Fifteen measles cases have been reported in Boston, Massachusetts, as of 22 June. The primary case in this outbreak is a 32-year-old unvaccinated person, who arrived in Boston from India at the end of April, nine days before developing a rash. The 15 cases are distributed over three generations of transmission; rash onset occurred between 5 May and 14 June. All case-patients were adults (age range = 23–45 years). Eight of the 15 affected persons have an unknown immunization history, two affected persons have one dose of measles vaccine given prior to 1968, three affected persons have had two doses of measles vaccine, and two were unvaccinated due to religious belief. Eleven of the cases were born in the United States.

Eight case-patients worked either at the same company or in the same building as the imported case. The epidemiological link of the remaining 6 cases is under investigation. One of these cases is a person who works a few blocks from the imported case's company at a religious organization which does not routinely accept vaccinations. This circumstance raised concerns about a potentially large pool of susceptible individuals. However, only one household contact was confirmed with measles as of mid-June.

Conclusions

As long as measles is endemic in other regions of the world, achieving a uniform >95% vaccine coverage among all birth cohorts and maintaining quality surveillance remain important strategies towards sustaining measles elimination in the Americas. Nonetheless, the three outbreaks described reemphasize previous lessons and provide new insight that might prevent the occurrence of contained, yet costly, outbreaks.

Ensuring the immunity of at-risk groups, reliable and timely notification of suspect cases from all public and private institutions, and measles immunity of residents traveling overseas could prevent many measles virus importations and significantly limit the consequences of those importations. Every country should conduct those activities consistently.

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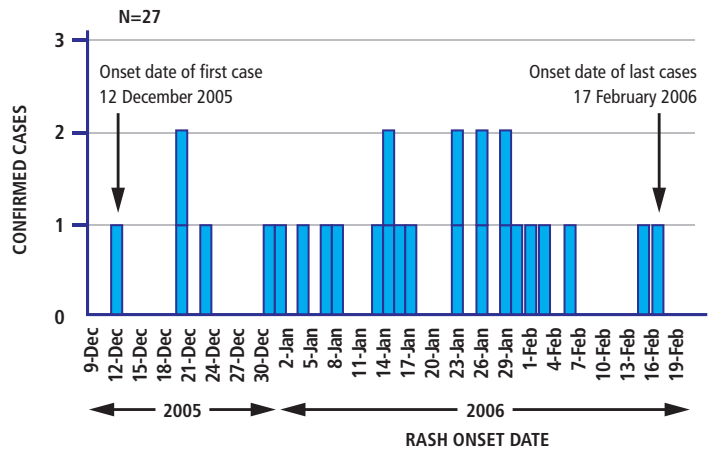
FIGURE 1 Epidemic curve of confirmed measles cases, Mexico, December 2005 to February 2006.



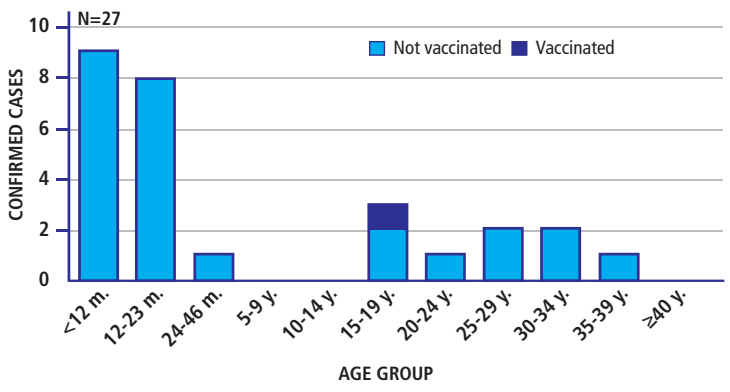
Source: Ministry of Health, Mexico.

TABLE 1. Selected outbreaks reported in WHO European Region, 2006.

Country	Month and year outbreak began	Number of reported cases during first semester 2006*	Measles virus genotype detected
Ukraine	February 2005	>17,000	D6
Germany	January 2006	>1,400	D4, D6
Romania	October 2004	>700	D4
Spain	February 2006	>300	B3,D6
England and Wales	March 2005	181	B3
Greece	November 2005	171	B3
Poland	January 2006	60	...

*Number of reported cases is as per last published update. ... Not available
Source: References (5) through (11).

FIGURE 2 Distribution of confirmed measles cases by age and vaccination status, Mexico, December 2005 to February 2006.



Source: Ministry of Health, Mexico.

Lessons Learned from Recent Measles Outbreaks

- Groups of workers at risk should be defined and their measles immunity verified at regular intervals. These groups include:
  - Health care workers (medical, administrative, and security personnel). These workers have the responsibility to avoid transmitting measles, as they are not only likely to be exposed, but also to expose other people to measles. Proof of measles immunity should be recommended for employment in any health care facility. Given the potential high turnover in personnel, public health officials should conduct a formal process of verification of this requirement at regular intervals. For instance, when active case-searches are done, immunity of all employees could be checked against personnel lists reporting dates of measles vaccination of each staff member. Proof of immunity to other vaccine-preventable diseases, such as rubella and hepatitis B virus, should also be recommended for health care workers.
  - Personnel from the tourism and transportation industries.
  - Groups not routinely accepting vaccination. Because these groups can hardly be convinced to accept measles or any other vaccination, they constitute a potentially large pool of susceptibles. Public health authorities should closely monitor occurrences of rash illness in these groups as soon as an importation occurs.
- Quality surveillance should be able to detect importations early on. The early detection of an imported case offers a unique chance to undercut an outbreak at its inception, when the branching out of the transmission chain is relatively simple. To be able to detect imported cases, a surveillance system must include facilities providing health care to tourists and private health care facilities, since, in many countries, people who can afford intercontinental travel are more likely to seek care in those institutions.
- Any resident of the Americas traveling outside the Western Hemisphere should be immune to measles before departure. Written proof of receipt of a measles-containing vaccine—preferably two doses, the first received after the first birthday and the second dose at least four weeks later—is the most practical assurance of measles immunity. Laboratory evidence, specifically the detection of measles-specific IgG antibodies in a serum specimen, could also be used as evidence of measles immunity, but this method is not practical for most people.

Prospective travelers aged >6 months who are not immune should be advised to receive measles-containing vaccines, preferably as measles-mumps-rubella (MMR) or measles-rubella (MR), ideally at least two weeks before departure. Infants aged 6–12 months who receive MMR before their first birthday must be re-vaccinated following the country's schedule. Exceptions include travelers with medical contraindications to measles-containing vaccines, such as severe immunosuppression and pregnancy.

A requirement that all incoming passengers be vaccinated against measles would have little efficacy, as most incoming susceptible passengers who might have been exposed to measles would likely be arriving after having been exposed. Vaccination upon arrival would not prevent these passengers from developing measles in most cases. Both the current and the 2005 revised International Health Regulations[4] do not consider measles vaccination. The general rule in the Regulations is that no vaccination certificate, other than those provided for under the Regulations (currently only for yellow fever) or in recommendations issued by WHO, shall be required for international travel.

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August 2006
Volume XXVIII, Number 4

XVII TAG Meeting—Protecting the Health of the Americas: Moving from Child to Family Immunization

The XVII Meeting of the Technical Advisory Group (TAG) on Vaccine-preventable Diseases of the Pan American Health Organization (PAHO) was held from 25-27 July 2006 in Guatemala City, Guatemala. TAG meets every two years and functions as the principal forum for providing advice to PAHO Member States on vaccine policies and disease control efforts. The following is a summary of TAG's technical deliberation and recommendations as presented in the final report.

TAG recognized the substantial progress achieved by member countries since the last meeting in 2004. This year's meeting focused on the new challenges involving the transition from child to family immunization and the unfinished agenda.

Dr. Ciro de Quadros, Chairman of the TAG, opened the meeting. He was followed by Dr. Rudy Eggers, WHO, Geneva, who reiterated the call for action on rubella elimination. Dr. Mercy Ahun presented on behalf of the Global Alliance for Vaccines and Immunization (GAVI), highlighting the need to continue to support the world's poorest countries. Dr. Gina Tambini, Manager, Family and Community Health Area, PAHO, provided participants with an update on the status of the follow-up of recommendations of the 2004 TAG meeting in Mexico City. Representatives from partner organizations such as the US Centers for Disease Control and Prevention (CDC), GAVI, PATH, Sabin Vaccine Institute, and UNICEF made statements of support to immunization programs in the Region. Dr. Joxel García, Deputy Director, PAHO, and Marco Tulio Sosa, Minister of Health of Guatemala, officially opened the meeting by making remarks stressing the importance of achieving and sustaining Regional initiatives such as measles and rubella elimination. Dr. Jon Kim Andrus and Dr. Tambini served as ad-hoc Co-Secretaries of the meeting.

Measles

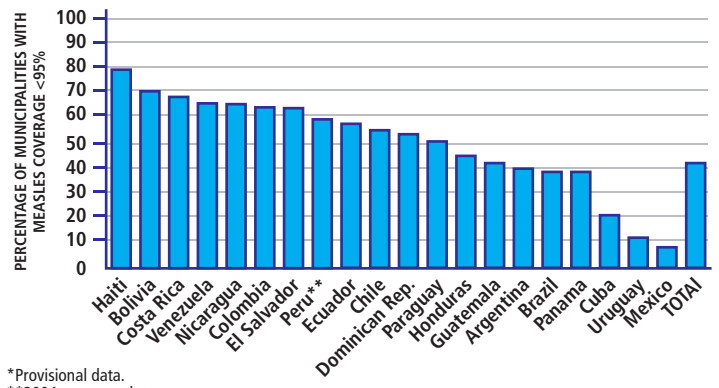
Absence of widespread measles virus transmission since November 2002 is proof of the success of the measles elimination initiative in the Americas. However, the endemic measles virus circulation in other parts of the world puts our Region under constant threat of importations. Fifty-one percent of the 370 measles cases reported in the Americas between January 2003 and April 2006 were positively linked to an importation. Importations occurred from all other WHO Regions. Six outbreaks with >10 cases were detected since 2003 (range = 10–108 cases).

Countries must avoid becoming complacent to the risk of measles importation and the potential for reestablishment of endemic measles transmission. Occurrence of measles cases among children aged 1–4 years in outbreaks in Mexico and Venezuela indicates a weakening of routine vaccination. National follow-up campaigns that should have been conducted every 3 to 4 years have either been cancelled or postponed indefinitely in some countries. Finally, indicators of integrated measles/rubella surveillance have not shown improvement or have worsened. While coverage with measles-containing vaccine at regional level was 93% in 2004, 42% of municipalities had coverage below 95%— an indication that coverage remains uneven and that significant pockets of susceptible groups exist in our Region.

Recommendations

- Countries should identify municipalities with less than 95% coverage for measles-containing vaccine and devise strategies to reach and maintain coverage in the 95%–100% range in every municipality.
- High-quality nationwide follow-up campaigns (achieving coverage ≥95% in every municipality) should be conducted every 3 to 4 years (earlier if a susceptible accumulation above 80% of a typical birth cohort has accumulated), irrespective of whether a second MMR dose is included in the national routine immunization schedule. Only where coverage ≥95% with each of the two MMR doses is guaranteed for all municipalities can the follow-up campaigns be waived.
- Vaccination of at-risk professional groups, such as workers in the health care, transportation, and tourism sectors, is recommended and should be verified regularly through an established formal process.
- Any resident of the Americas traveling to areas with reported measles (or rubella) cases should be immune to measles (and rubella) before departure. Requesting proof of vaccination from incoming travelers is not advised.
- Integrated surveillance for measles/rubella should include private institutions, including those attended by tourists, to increase sensitivity and timely detection of imported cases.

FIGURE 1 Percentage of municipalities with measles vaccination coverage <95% in children aged 1 year, 2005.*



*Provisional data.
**2004 coverage data.
Source: Country reports through the PAHO/WHO/UNICEF Joint Reporting Forms (JRF).

2007

February 2007
Volume XXIX, Number 1

Update on Measles Outbreaks in the Americas

Endemic transmission of indigenous measles virus was interrupted in the Americas in November 2002. However, sporadic cases and outbreaks associated with importations continue to occur.[1] In this article, we describe recent measles outbreaks in the post-elimination era in Brazil and Venezuela.

Brazil, August-November 2006

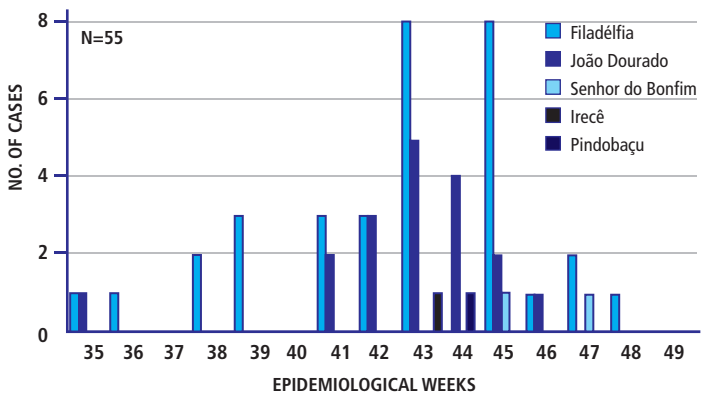
Brazil interrupted indigenous measles transmission in 2000. Between 2001 and 2004, only 4 measles cases were reported, all imported from Europe and Japan. In 2005, a six-case outbreak occurred following an importation from the Maldives Islands.[2]

In November 2006, Bahía State reported a measles outbreak of 55 confirmed cases. The first cases had rash onset in late August (Epidemiological Week/EW 35) and the last case occurred in EW 49, 2006 (Figure 1). Cases occurred in five rural municipalities: João Dourado (18 cases), Filadélfia (33), Irecê (1), Senhor do Bonfim (2), and Pindobaçu (1). João Dourado and Irecê are contiguous municipalities, as are Filadélfia and Senhor do Bonfim. João Dourado and Filadélfia accounted for 93% of the cases. The majority of cases were men: 55% in João Dourado and 79% in Filadélfia. The age of the cases ranged from 7 months to 37 years (Figure 2). None of the cases had a history of being vaccinated. Seven cases were hospitalized. No deaths were reported. The measles genotype identified in João Dourado was D4, genetically related to the measles virus that was imported to Canada in 2006. D4 has been isolated in Europe, Africa, and Asia.

The outbreaks in João Dourado/Irecê and Filadélfia/Senhor do Bonfim took place simultaneously. Cases in Filadélfia/Senhor do Bonfim were identified and reported late. In João Dourado/Irecê, cases occurred among persons living on the same street. Most cases were among persons aged <15 years (Figure 2). In contrast, in Filadélfia/Senhor do Bonfim, most cases were men aged >15 years. The source of the virus and the epidemiological link between cases in João Dourado/Irecê and Filadélfia/Senhor do Bonfim have not yet been identified. The affected areas in Bahía are heavily traveled due to the extensive trading of agricultural products and migration of agricultural and mine workers.

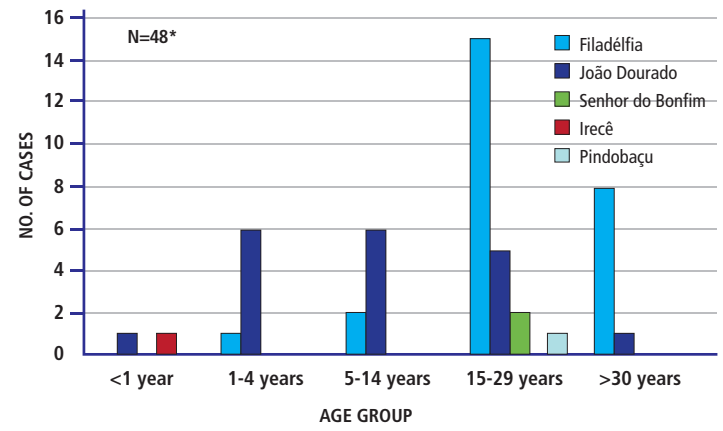
All suspect cases were investigated by home visits, exhaustive contact follow-up, and collection of blood for serology testing and nasopharyngeal specimens for virus isolation. Difficulties in ensuring timely specimen collection and laboratory kit stock-outs resulted in delayed laboratory confirmation of some of the cases and the inability to isolate the virus from Filadélfia. Extensive vaccination was targeted to reach susceptible persons living in the outbreak locale. Routine vaccination was strengthened. Active case-searches were conducted in health care facilities and the community, including schools,

FIGURE 1 Confirmed measles cases by epidemiological week of rash onset, municipalities of Bahía State, Brazil, 2006.



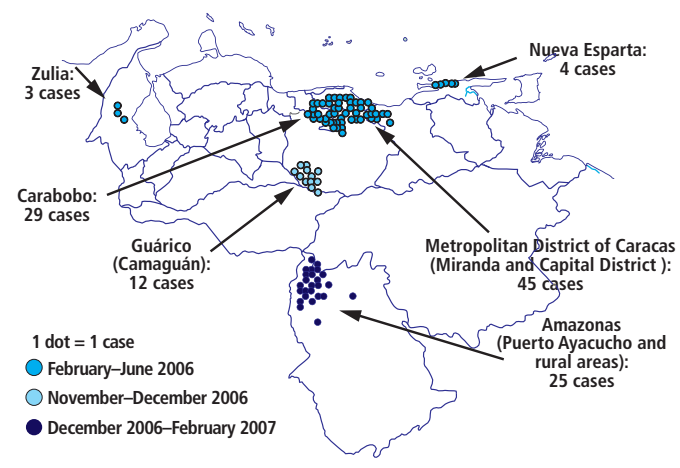
Source: Ministry of Halth, Brazil. Data as of 13 February 2007.

FIGURE 2 Confirmed measles cases by age group, municipalities, of Bahía State, Brazil, 2006.



*Data for 7 cases not shown.
Source: Ministry of Health, Brazil. Data as of 13 February 2007.

FIGURE 3 Geographic distribution of confirmed measles cases, Venezuela, 2006–2007.



Source: Ministry of Health, Venezuela.

businesses, and commercial areas. Approximately 30,000 persons were vaccinated. A measles alert and technical information were disseminated nationwide.

Due to the increased vaccine demand following this outbreak and rubella outbreaks in Minas Gerais and Rio de Janeiro, Brazil has purchased 1 million measles-mumps-rubella (MMR) vaccine doses and 4.2 million measles-rubella (MR) vaccine doses through PAHO's Revolving Fund. The country has requested an additional five million MR and MMR vaccine doses from the Revolving Fund, as it is planning to conduct measles/rubella vaccination activities in susceptible groups in 2007.

Venezuela, November 2006 – February 2007

From February to June 2006, Venezuela reported a measles outbreak of 81 confirmed cases (45 in the capital city Caracas, 29 in Carabobo State, 4 in Nueva Esparta State, and 3 in Zulia State) (Figure 3). The index case-patient traveled to Spain during the period of exposure. The virus isolated from this outbreak was B3, the same genotype circulating in Spain. Venezuela had not reported cases since 2002.[3]

After epidemiological silence, Venezuela reported another cluster of 12 confirmed cases in November 2006. All cases were residents of the Camaguán municipality in Guárico State. Genotyping is pending.

In December 2006, the country reported another measles outbreak in Puerto Ayacucho, in Amazonas State. A total of 25 cases were confirmed. The rash onset of the last case was on 15 February 2007. Twenty three of the confirmed cases are children aged <5 years; 14 cases are infants aged <1 year. Coverage levels in Amazonas State have historically been low. Active measles case searches are being conducted in Puerto Ayacucho and will be extended to the rest of the country. Of all 118 confirmed cases reported since February 2006, only 4 had a history of being vaccinated.

Conclusion

Best practices for outbreak response include intensifying epidemiological surveillance, quality case investigation, and follow-up of contacts. Vaccination activities aim to get ahead of virus transmission. They should target contacts and persons in places of possible transmission and/or possible exposure, and in places commonly frequented by the case.

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XIX Meeting of the Central American Region, Mexico, and the Latin Caribbean

The XIX Meeting of the Central American Region, Mexico, and the Latin Caribbean on vaccine-preventable diseases took place in Santo Domingo, Dominican Republic, from 6-8 June 2007. Delegations from Costa Rica, Cuba, the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, and Panama participated in the meeting.

During the opening ceremony, Dr. Gina Tambini, Area Manager, Family and Community Health, PAHO, spoke of the need for countries to focus on completing the unfinished agenda in immunization. Representatives of the Centers for Disease Control and Prevention of the U.S. (CDC), the U.S. Agency for International Development (USAID), the Church of Jesus Christ of Latter-day Saints, and UNICEF also were in attendance.

In a special session, PAHO presented the President of the Republic, Dr. Leonel Fernández, and the Secretary of Public Health, Dr. Bautista Rojas Gómez, awards for their commitment to the National Immunization Days conducted from 30 October to 10 December 2006. The awards were intended to recognize the hard work of vaccinations teams and the excellent coverage rates obtained following the country's intense efforts to eliminate rubella and congenital rubella syndrome (CRS), and maintain measles elimination.

Rubella and Measles

Countries of the Region have demonstrated progress in effectively interrupting endemic rubella transmission. In addition, mass vaccination campaigns conducted in the Region have been essential to sustain measles elimination. All but one of the 345 measles cases reported in the Americas since 2005 have been in countries that still had not conducted or concluded a mass vaccination campaign against measles and rubella in adolescents and adults.

Integrated and quality epidemiological surveillance of measles and rubella, including case confirmation through laboratory tests, is a fundamental element to document the rubella and measles elimination in the Americas. Furthermore, molecular epidemiological data can be used to confirm rubella elimination. Finally, CRS surveillance is recommended to identify infants in whom this syndrome is suspected.

- The accumulation of measles susceptibles should continue to be monitored. A high quality follow-up campaign (coverage >95% in every municipality) is necessary whenever there is evidence of an accumulation of susceptibles.
- Countries should identify municipalities with MMR coverage <95% and design strategies to achieve and maintain 95%-100% coverage in all municipalities.
- Countries should ensure that all residents of the Americas who travel to endemic measles and/or rubella areas are immune to measles and rubella before their departure.
- Countries should develop plans to deal with importations, ensuring that a dedicated team is on hand and available funds can be rapidly released.
- Countries should maintain active epidemiological surveillance of measles and rubella in all the municipalities, with a sensitivity of at least 2 suspect cases per 100,000 inhabitants and at least 1 suspect case in municipalities with <100,000 inhabitants, and conduct active case-finding in high-risk municipalities and silent areas. Furthermore, rapid investigation should be the norm (before serology results are available) and include representative samples for viral detection.
- While investigating sporadic suspect cases during the last stages of measles and rubella elimination, a second sample should be collected for serology and an epidemiological analysis conducted when the laboratory result is not clear. Also, samples should be collected for viral isolation or detection by molecular method.
- Countries should start documenting the interruption of measles and rubella endemic transmission based on the following components:

  a. epidemiological information on measles, rubella, and CRS (vaccination impact);
  b. vaccination coverage and analysis of protection;
  c. quality of the surveillance system;
  d. data on molecular epidemiology of measles and rubella virus; and
  e. data from available seroprevalence studies.

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2009

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Measles and Rubella Laboratory Network in the Americas

During the verification phase of the interruption of endemic transmission of measles and rubella viruses, it is essential to maintain high quality laboratory surveillance. The role of the laboratory is to provide the essential data to classify suspected cases and to provide molecular epidemiologic information about the viruses circulating in the Region of the Americas. The information should be analyzed and reported in an effective and timely manner to allow implementation of adequate public health measures.

The measles and rubella laboratory network in the Americas was established in 1995 and is part of the World Health Organization (WHO) Global Measles and Rubella Laboratory Network. The network has implemented standardized diagnostic and testing methods, as well as a comprehensive quality assurance program, which includes proficiency testing, confirmatory testing, an accreditation process, and weekly notification of the laboratory performance indicators. Laboratory results are reported to the Pan American Health Organization (PAHO) in a timely manner.

The laboratory surveillance guidelines were reviewed by a group of representatives from the Global Specialized Laboratory (GSL), the Regional Reference Laboratory (RRL), and national laboratories during a meeting at PAHO Headquarters on 27 August 2008. The group proposed a laboratory protocol be used for documenting and verifying the interruption of endemic measles and rubella transmission. The participants emphasized that both the public health authorities and laboratories have a role in ensuring optimum laboratory performance.

Recommendations

1. Quality Control: Documentation of measles and rubella elimination requires that each participating laboratory produce the highest quality laboratory surveillance data possible. Each country must report results from a laboratory fully accredited according to current WHO LabNet standards and using the PAHO-modified checklist. Accreditation includes:

   - Assessment of proficiency testing for IgM, routine

testing results, and confirmatory testing for serologic assays;
- Review of internal quality control measures;
- Review of laboratory standard operating procedures (SOPs) including protocols for biosafety and containment of infectious material;
- Training and qualifications of laboratory staff;
- Timeliness of testing;
- Integration of laboratory with epidemiology;
- Timeliness and completeness of result reporting to PAHO;
- Timeliness of forwarding samples for virus isolation to the RRL;
- Maintenance of inventories of all samples and potentially infectious material.

Specific points include the following:

a. Participation in the global proficiency testing program for serologic testing: The panels are provided to assess the proficiency of the laboratories to detect measles and rubella IgM by enzyme immunoassay (EIA). All WHO LabNet laboratories receive proficiency panels prepared by the Victorian Infectious Disease Laboratory (VIDRL) in Melbourne, Australia. Distribution of the panels is conducted by the U.S. Centers for Disease Control and Prevention (CDC) and requires coordination with country program representatives, laboratory managers, and the PAHO Laboratory Coordinator (LC). Testing and reporting of results (including optical density readings) must adhere to the requirements of timeliness described in the accreditation documents. Upon submission of results, the laboratory will receive a report within 10 days. Results are forwarded to WHO Headquarters and VIDRL for inclusion in the global report.

b. Provision of serum from routine testing to the designated referral laboratory for confirmatory testing: To ensure confidence in the quality of the network's serologic testing for measles and rubella Igm detection, the LC will randomly chose a national laboratories (NL) that will send serum samples for confirmatory testing once a year to the corresponding RRL according to the plan previously developed by the LC and the Reference Laboratories. The criteria to select the samples for confirmatory test are the following: 10 samples with negative results, 10 samples with measles-positive results, 10 samples with rubella-positive results, 10 samples equivocal for measles, and 10 samples equivocal for rubella. A form, provided by the LC or by the GSL or RRL, should accompany the serum samples so that the 2 sets of results can be reviewed. Results will be evaluated by the GSL or RRL and communicated to the LC. If discordant results occur, additional testing or consultation with the laboratories will be initiated by the LC to address any potential problems. The GSL or the RRL, in coordination with the referral laboratory, will prepare a schedule for shipment of the samples to the referral laboratory and, if necessary, will determine the best method of shipment and whether alternative sample protocols (e.g., filter paper) are appropriate.

c. Documentation of the data generated throughout the laboratory network for quality assurance: Summaries with all laboratory performance data including accreditation status, results from proficiency panels and confirmatory testing should be documented.

d. Sporadic IgM positive cases are expected when disease prevalence is low and reflect good surveillance: The recording of these cases in a standard format will allow the aggregate evaluation of such cases as part of the review of overall laboratory surveillance and will aid in the documentation of elimination.

2. Case Classification and Laboratory Testing: In an elimination setting, case classification can sometimes be challenging and often requires additional testing and clinical specimens. In this regards it is imperative that countries strengthen virological surveillance. An adequate specimen for virus isolation can improve the sensitivity of the serology in the first days of the disease when serology results can be inconclusive. It allows for the genetic characterization of the virus, which is fundamental for an elimination program in the Region. A negative virus isolation result does not rule out measles or rubella infection because the test is much affected by the timing of specimen collection and specimen quality, which can be affected by storage and transportation. In this situation a second serum specimen (convalescent phase) is indicated to verify seroconversion.

Countries should be aware of the limitations of laboratory testing. To detect IgM to measles and rubella, all laboratories are using commercial EIA assays that have been fully validated and have excellent sensitivities and specificities. Still, no serologic test will be sufficient for all cases. Collection of additional samples for viral detection provides another means to confirm a case and the genetic information provides valuable information about the transmission pathways of the virus. Though these samples are requested, they are difficult to obtain for many cases because of the problems associated with specimen collection, transport, and storage. A second serum sample can also help to improve the laboratory's ability to classify cases, but many cases are unfortunately lost to follow-up.

Accurate case classification depends on careful review of all laboratory results and epidemiologic data.

a. Cases should be classified after the laboratory and epidemiologic teams have reviewed all laboratory and epidemiologic data.

b. The laboratory and epidemiologic teams from each country should develop a country-specific testing algorithm for case classification. The laboratory components of the algorithm must include additional testing measures to be used to classify sporadic cases (isolated case with no travel history or known epidemiologic links) to rule out false positive or false negative IgM test results. The algorithm should include:
   - Protocol for confirming an IgM test result;
   - Adequate sample for virus isolation from as many suspected cases as possible; in addition, laboratories should obtain genetic data from all outbreaks;
   - Guidance for determining when to attempt collection of a second serum specimen;
   - Instructions for use of additional serologic tests: rise in IgG titers and avidity testing;
   - Guidance on whether to perform testing for other etiologic agents at the national laboratory or the RRL, considering available capacity and resources.

c. The laboratory should provide guidance to field staff for adequate specimen collection, storage, and transportation.

d. The laboratory testing algorithm must include a provision for laboratories that do not perform virus isolation to forward clinical specimens from confirmed cases to the designated regional reference laboratory for virus isolation and genetic testing. Shipment should occur within 15 days after collecting the specimens, confirming the cases, and obtaining all necessary permits and permissions.

e. The laboratory testing algorithm must include a provision for laboratories that perform virus isolation, but do not perform sequencing, to forward the original specimen and isolates for genetic testing to the designated RRL within 15 days after confirming successful isolation of measles and rubella and obtaining all necessary permits and permissions.

f. Countries may develop a plan for using alternative samples (dried blood or oral fluid) for expanding surveillance.

3. Data Reporting and Strain Bank Submission: Timely reporting of sequencing data and viral genotypes is critical. Developing regional databases of infectious material will also help with future containment programs.

a. Laboratories performing sequencing should notify the PAHO LC as soon as possible after obtaining the genotype information.

b. Laboratories should submit genotype information to the SharePoint database at WHO Headquarters and the PAHO LC within two months of completing the sequence. Laboratories are strongly encouraged to submit the viral sequence data to GenBank and the designated sequence databases.

c. Laboratories should forward representative viral isolates to the WHO Strain Bank at the CDC after consultation with the PAHO LC and WHO Strain Bank.

4. Additional Recommendation: Genetic baseline determination obtained using archival serum samples and oral/nasopharyngeal and tissue specimens should be used in countries and/or subregions where baseline information is lacking.

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Measles Virus Importations: A Continuing Struggle for the Americas

Several imported measles outbreaks have occurred in the Region of the Americas in recent years, with a small number of cases secondary to importation. In the period 2008-2009, there were 203 secondary cases from a total of 57 importations (Tables 1 and 2). In 23 cases, the origin of the infection was unknown.[1] Sixty percent of imported measles cases in the Americas during that period came from Europe, with outbreaks occurring in Argentina, Canada, Chile, Ecuador, Jamaica, Peru, and the United States.

Mounting a rapid response to limit these outbreaks has involved the intensive mobilization of human and financial resources in countries. Recent experiences in Chile and Peru reveal an estimated cost of US $12,400 and $40,000, respectively to contain the outbreak.[2] No secondary case was reported in either country.

The private sector plays a key role in the detection and rapid response to outbreaks. In the period 2008-2009, 77% of measles cases reported in Latin America and the Caribbean were detected in the private sector.[3] Therefore, private-sector participation in surveillance activities should be strengthened by establishing partnerships with medical associations and scientific societies. Partnerships should also be considered with tourism boards since the virus is usually imported by them to the Region.

Given the tremendous investment that countries are making to contain outbreaks, measles elimination efforts in other regions of the world should be intensified. Such an initiative would be a step toward global measles eradication. The World Health Organization (WHO) will conduct a measles eradication feasibility study, whose final report will be submitted to the WHO Executive Board in 2010.

References
1. Data as of Epidemiological Week 23/2009.
2. Source: Country reports to PAHO.
3. Data as of Epidemiological Week 23/2009.

TABLE 1. Imported measles cases in the Americas, 2008.

Country	Total importations	Total cases associated with importation	Source
Ecuador	1	0	Italy
Jamaica	1	1	United Kingdom
Peru	1	0	India
Canada	8	54	France, India, Israel, Morocco, Pakistan, Switzerland
United States*	24	102	Belgium, China, Germany, India, Israel, Italy, Philippines, Russia, Switzerland, United Kingdom, Vietnam

* In 2008, the United States reported 14 cases whose source of infection was unknown.

TABLE 2. Imported measles cases in the Americas, 2009.*

Country	Total importations	Total cases associated with importation	Source
Argentina	1**	2	United Kingdom
	1	0	United Kingdom
Canada	1	5	Belgium
	1	0	China
	1	0	United States
Chile	1	0	France
United States***	22	23	Cabo Verde, China, India, Italy, United Kingdom

* Data as of EW 23/2009.
** The case corresponds to EW 51/2008; however, the secondary cases appeared in EW 2/2009.
*** As of EW 23/2009, the United States reported 9 cases whose source of infection was unknown.

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