

Epidemiological Alerts and Updates

Annual Report 2017



Pan American
Health
Organization



World Health
Organization

REGIONAL OFFICE FOR THE Americas

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Epidemiological Alerts and Updates. Annual Report - 2017

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Acronyms and abbreviations

AFM	Acute-flaccid myelitis
AFP	Acute-flaccid paralysis
CFR	case fatality rate
EW	epidemiological week
GBS	Guillain-Barré Syndrome
IHR	International Health Regulations
NFP	National Focal Point
PAHO	Pan American Health Organization
PCR	polymerase chain reaction
RT-PCR	real-time polymerase chain reaction
RNA	ribonucleic acid
WHO	World Health Organization



Introduction

Over the past six years, the Pan American Health Organization (PAHO), Regional Office for the Americas of the World Health Organization (WHO) has published an annual report on the PAHO/WHO Epidemiological Alerts and Updates disseminated during the respective year, and which reported and alerted Member States of public health events that could have implications beyond their borders.

Most of the Epidemiological Alerts and Updates issued refer to infectious agents, however they may be related to other factors such as contaminated goods, food safety, among other areas considered in the International Health Regulations (2005). The Epidemiological Alerts and Updates are additionally an important form through which PAHO/WHO shares with countries advice and recommendations on how to manage the concerned health event. The Alerts and Updates are also utilized to highlight events that are not frequent or that are novel to the Region of the Americas.

The annual reports aim to collect and compile the knowledge and recommendations embodied in the Epidemiological Alerts and Updates to provide an overall document for Member States to consult and learn from as desired.

In 2017, PAHO/WHO disseminated 43 Epidemiological Alerts and Updates including recommendations to address the events, such as public health measures necessary to minimize the risk of the events occurrence. As an example, between January to December 2017, PAHO/WHO disseminated 21 Epidemiological Alerts and Updates concerning yellow fever in the Region of the Americas. These periodically reported on changes in the circulation of the virus and updated the recommendations issued to Member States based on adjustments in the risk assessment.

During 2017, PAHO/WHO also continued to issue Epidemiological Updates on Zika virus disease, including Guillain-Barré Syndrome (GBS) and congenital syndrome associated with Zika virus infection. At the beginning of the year, PAHO/WHO alerted Member States of the risk of outbreaks and the increase of malaria transmission in endemic areas, as well as the possible reintroduction of the disease in places where the transmission had previously been interrupted.

Since May 2017, PAHO/WHO warned of the risk of imported cases and of the occurrence of measles outbreaks via successive Epidemiological Alerts and Updates. Similarly, outbreaks of diphtheria in the region and their progress were reported on, including recommendations for strengthening surveillance systems to detect suspected cases and initiate case and contact treatment immediately. Member States were also reminded of the need to ensure adequate supplies of diphtheria antitoxin, and the key role of adequate clinical management in reducing complications and the lethality of the disease was emphasized.

In 2017, as well as prior years, the dissemination of these Epidemiological Alerts and Updates has only been possible due to the contributions of Member States.

PAHO/WHO reiterates the importance of continuing to contribute to regional and global surveillance through the timely notification of events that may pose a threat to international public health.

Acute flaccid myelitis (AFM) associated with D68 human enterovirus infection in the context of acute flaccid paralysis surveillance

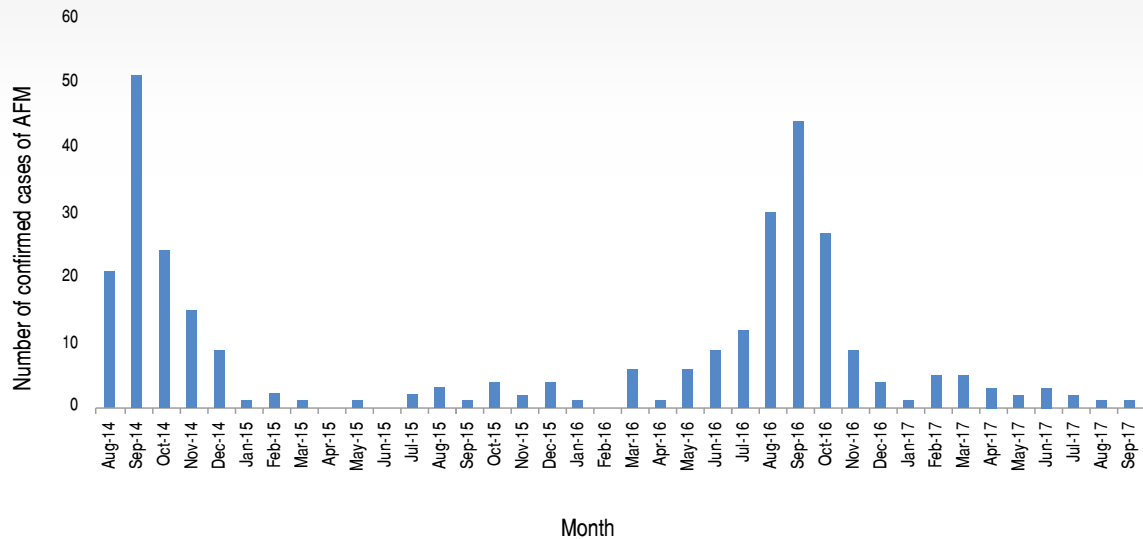
1 November 2017¹

Although sporadic cases of enterovirus infection have been reported since the 1960s, it was not until August 2014 that the first outbreaks were documented in the United States of America.⁽¹⁾ Between August and December 2014, the United States Centers for Disease Control and Prevention (CDC) reported an increase in cases of acute flaccid myelitis (AFM) associated with an outbreak of respiratory disease caused by enterovirus (EV) D68.^(2,3) Of 120 reported cases of AFM reported in 34 states, the median of the age was 7.1 years (range: 4.8 to 12.1 years), 59% were male and 81% presented respiratory disease before the onset of neurological symptoms.^(4,5) Following this event, voluntary surveillance of AFM was initiated in some states, detecting sporadic cases in 2015, and a new increase in cases in 2016 (Figure 1). Cases were also detected in Asia, Canada, and Europe.⁽¹⁾

EV-D68 shares characteristics with rhinoviruses, causing mainly respiratory diseases; however, its role in the pathogenesis of neuroinvasive diseases is not clearly understood.

¹ PAHO/WHO. Epidemiological Alert: Acute Flaccid Myelitis associated with enterovirus D68. 1 November 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2qYFx1U>

Figure 1. Cases of acute flaccid myelitis (AFM), United States, by month, August 2014 to July 2017



Source: Published by the U.S. CDC and reproduced by PAHO/WHO

In 2016, the European Center for Disease Control and Prevention (ECDC) reported that Denmark, France, the Netherlands, Spain, Sweden, and the United Kingdom had reported clusters and isolated cases of severe neurological syndromes associated with enterovirus infection in children and adults, among which EV-D68 was detected.²

In October 2017, the Argentina IHR NFP reported a cluster of acute flaccid myelitis (AFM) associated with EV-D68 infection. Between EW 13 and EW 21 of 2016, 15 cases of AFM were identified in residents of the provinces of Buenos Aires (13 cases) and Chubut (1 case), and in the Autonomous City of Buenos Aires (1 case). All cases were in children under 15 years of age; detection occurred in the context of acute flaccid paralysis (AFP) surveillance. This event coincided with the increase in AFP cases in children under 15 years of age observed at the national level between EW 16 and EW 21 of 2016. In 6 of the 15 reported AFM cases, the Regional Poliovirus Reference Laboratory - INEI – ANLIS “Dr. Carlos G. Malbran” detected the presence of EV-D68. Positive results were obtained in samples of nasopharyngeal aspirate, and, in one case, the same result was also obtained in a cerebrospinal fluid (CSF) sample. In addition, human EV B and human EV C were detected in stool samples of 2 of the AFM cases; rhinovirus C in one case and coxsackievirus A13 in another.

Considering the context of polio eradication,³ the switch from trivalent oral polio vaccine (OPV) to bivalent OPV since April 2016, that AFM is a type of AFP, and the need to increase the knowledge about the role of enteroviruses in the epidemiology of neuroinvasive diseases, PAHO/WHO reminded Member States that enterovirus is part of the differential diagnosis of AFP.

Following is a series of recommendations on surveillance, including laboratory detection, to guide health authorities on this subject.

² European Centre for Disease Prevention and Control. Communicable disease threats report, 13-19 November 2016, week 46. Available at: <https://ecdc.europa.eu/en/publications-data/communicable-disease-threats-report-13-19-november-2016-week-46>

³ The last wild poliovirus case detected in the Americas was in 1991.

Recommendations

Case management

A patient with suspected AFM shall have timely access to health services that manage neurological syndromes. The capacity to make a differential diagnosis is key for defining complementary tests, treatments to follow, guiding rehabilitation and, finally, determining the prognosis.

Surveillance

AFM surveillance associated with enteroviruses is a component of AFP surveillance and, as such, supports polio eradication efforts. The quality of this surveillance is measured based on the usual performance indicators of AFP surveillance, advising to:

- ❶ Investigate all AFP cases in children under 15 years of age or of any age where polio⁴ is suspected within 48 hours of notification. All AFP cases should be reported within 14 days of the onset of paralysis.
- ❷ If there is a strong presumption of AFM, a respiratory sample (necessary for the detection of enterovirus D68) should be obtained and a spinal nuclear magnetic resonance should be considered.
- ❸ Investigate any increase or cluster of AFP. In this situation, if cases have clinical characteristic of AFM, a respiratory sample in addition to the stool sample should be obtained.
- ❹ Follow up cases, 60 days after the beginning of the paralysis, to determine if they have residual paralysis.

Laboratory

Laboratory detection of poliovirus by is based on virus isolation in cell cultures (L20B and RD), intratypical differentiation by real-time polymerase chain reaction (RT-PCR) and genetic sequencing.

Detection of EV-D68 is performed by molecular techniques (RT-PCR) that can be both conventional or in real time. For respiratory viruses other than influenza detection protocols, a generic PCR test for enterovirus (respiratory) detection followed by PCR with specific primers for EV-D68 in positive samples is recommended.⁵

EV-D68 is a respiratory virus that can be better detected in respiratory specimens. Therefore, in the presence of EV-D68, a nasopharyngeal swab sample should be collected in viral transportation medium or nasopharyngeal aspirate in physiological solution. CSF samples taken (only) by medical prescription may also be used for virus detection. Stool samples that were collected to discard poliovirus may also be used; however, the possibility of detecting EV-D68 in this type of sample is low. Note the stool sample should be obtained within 14 days of paralysis.

⁴ Use of the case definition published in the PAHO/WHO scientific and technical publication No. 607 – “Poliomyelitis Eradication Field Guide,” is advised. Available at: <https://bit.ly/2HXRZpM>

⁵ For molecular detection, the implementation of the CDC protocols, “Enterovirus D68 (EV-D68) 2014 outbreak strain-specific real-time reverse transcription / Polymerase chain reaction (rRT-PCR) assay instructions-Version 10/14/2014,” is recommended. Available at: <https://stacks.cdc.gov/view/cdc/25698>

Collection and shipping of samples

The quality of obtaining, transporting, and storing the collected samples (whether respiratory or stool) must be guaranteed. For this purpose, it is important that laboratories ensure that containers used to transport samples are adequate at both the central and subnational levels; the type and quantity (e.g., 8 grams for feces) of the sample is sufficient; the appropriate cold chain is maintained, and the sample is correctly packed and identified.

For the collection and transport of respiratory samples, the PAHO/WHO “Operational Guidelines for Sentinel Severe Acute Respiratory Infection (SARI) Surveillance, 2014,” available at: <https://bit.ly/2HuyTYu>

References

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2. U.S. CDC. Acute flaccid myelitis in the United States. Centers for Disease Control and Prevention. Available at: <https://www.cdc.gov/acute-flaccid-myelitis/afm-surveillance.html>
3. Aliabadi N, Messacar K, Pastula DM, et al. Enterovirus D68 infection in children with acute flaccid myelitis, Colorado, USA, 2014. *Emerging Infectious Diseases*, 2016;22(8):1387-1394. doi:10.3201/eid2208.151949.
4. Sejvar J. et al. Acute flaccid myelitis in the United States, August – December 2014: Results of Nationwide Surveillance. *Clinical Infectious Diseases*. Volume 63, Issue 6, 15 September 2016, Pag 737–745. <https://doi.org/10.1093/cid/ciw372>
5. Messacar K, Schreiner TL, Go Haren K, Yang M, Glaser C TO, Tyler KL and Dominguez MR. Acute flaccid myelitis: a clinical review of US cases 2012–2015. *Ann Neurol.*, 80: 326–338. doi:10.1002/ana.24730.

Related links

- PAHO/WHO - Poliomyelitis: <https://bit.ly/2JrJ9Bv>
- PAHO/WHO Practical Guide: Inactivated polio vaccine (IPV) introduction. Washington, DC: PAHO, 2014. Available at: <https://bit.ly/2HOOH5u>



Cholera

24 February 2017⁶

In 2016, four countries of the Americas reported suspected and confirmed cases of cholera: the Dominican Republic (1,159), Ecuador⁷ (1), Haiti (41,421), and Mexico (1).

Dominican Republic. As of epidemiological week (EW) 2 of 2017, 7 suspected and 2 confirmed cholera cases had been reported, with 1 death. That figure was significantly less than the number of reported cases in the same period of 2016. Between EW 1 and EW 52 of 2016, 1,159 suspected cases of cholera were reported, with 27 deaths and a CFR of 2.3%. The total number of cases reported in 2016 was higher than in 2014 and 2015.

Haiti. Between EW 1 and EW 5 of 2017, 1,897 cases of cholera were reported, including 28 deaths, with a case-fatality-rate (CFR) of 1.5%. In that period, the number of reported cases was lower than in 2015 and 2016. The hospital CFR remained stable since 2011, at about 1%. Data by geographical division indicates that the departments with the highest number of cases in EW 5 of 2017, in descending order, were: Artibonite, Centre, Nord, Nord-Ouest, and Ouest, which includes the capital Port-au-Prince. In the Grand Anse and Sud departments, areas affected by hurricane Matthew on 4 October 2016, there was a limited number of suspected cases of cholera with a declining trend since their peak in EW 43 and EW 42, for Grand Anse and Sud, respectively.

Table 1 shows cases of cholera reported in the Dominican Republic and Haiti between 2010 and 2017.

4 May 2017⁸

Between EW 1 and EW 14 of 2017, there were 4,871 suspected cholera cases reported in Haiti, including 69 deaths. In the Dominican Republic, during the same period, 62 suspected cases and two deaths were reported.

Dominican Republic. Between EW 1 and EW 14 of 2017, 62 suspected cholera cases were reported, a 73% and 91% decrease from the numbers reported in the same period in 2015 and 2016, respectively. In 2017, 2 deaths were reported, while in the same period in 2016 and 2015, there were 15 and 10 deaths, respectively. The CFR was 3.2% in 2017, 2.2% in 2016, and 4.4% in 2015. In 2016, 20 provinces (included the Capital District) reported cases, however in 2017, only 10 provinces recorded suspected cases of cholera.

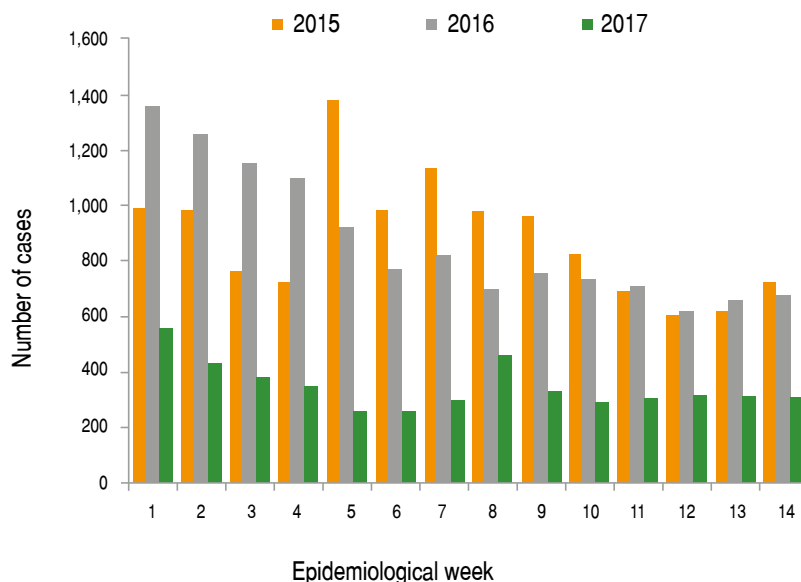
⁶ Pan American Health Organization / World Health Organization. Epidemiological Update: Cholera. 24 February 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2rh5Qk7>

⁷ Isolated cholera case, *Vibrio cholerae* serogroup O1, serotype Ogawa, biotype El Tor no toxigenic.

⁸ Pan American Health Organization / World Health Organization. Epidemiological Update: Cholera. 4 May 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2KsRUwa>

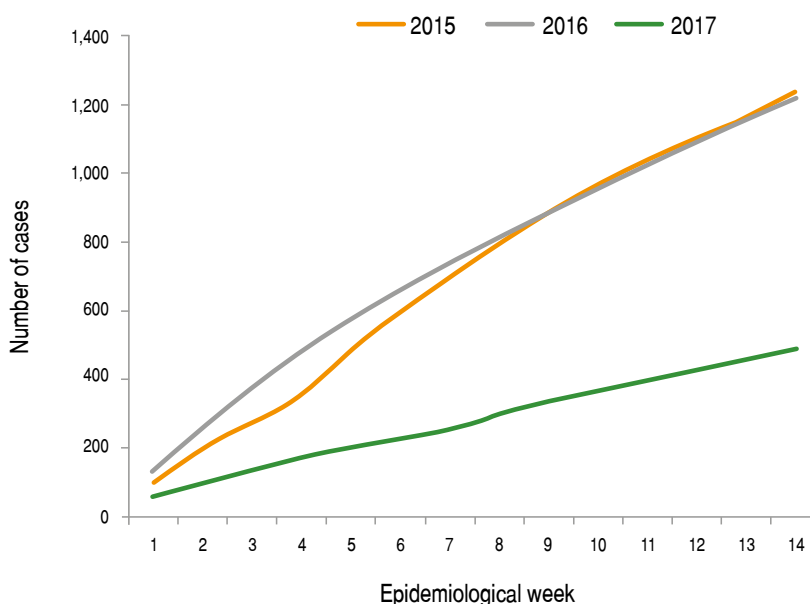
Haiti. Between EW 1 and EW 14 of 2017, there were 4,871 suspected cholera cases reported, that is, 60% and 61% less than in the same period in 2015 and 2016, when 12,373 and 12,226, suspected cases were reported, respectively. Figure 2 illustrates the decline in the number of cases during 2017, which remained constant for 14 weeks, and Figure 3 shows the cumulative number of cases in the same period. The 69 reported fatal cases during 2017 are 41% and 50% fewer than in the same period of 2015 (116) and 2016 (139), respectively. During the first 14 weeks of 2017, the hospital CFR was 1.2%, while during 2016 it had been 0.9%, and 0.8% in 2015.

Figure 2. Number of suspected cases of cholera reported, by EW, and by year, Haiti, EW 1 to EW 14, 2015-2017



Source: Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Epidémiologie de Laboratoire et de Recherches (DELIR).

Figure 3. Cumulative number of suspected cholera cases, by EW and by year, Haiti, EW 1 to EW 14, 2015-2017



Source: Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Epidémiologie de Laboratoire et de Recherches (DELIR).

All 10 departments of Haiti reported cases of cholera during 2017. Between EW 11 and EW 14 of 2017, incidence rates ranged between 39.5 and 3.2 per 100,000 population. The five departments with the highest rates, in descending order were: Centre, Ouest (which includes the capital, Port-au-Prince), Nippes, Artibonite, and Nord.

28 December 2017⁹

Between EW 1 and EW 50 of 2017, there were 13,582 suspected cholera cases reported on the island of Hispaniola, 99% of them in Haiti (13,468 cases, and 157 deaths).

Although both in Haiti and the Dominican Republic the number of cases declined when compared to 2016, in the Dominican Republic the reduction was larger, since the rate per 100,000 population dropped from 12.8 in 2016 to 1.21 in 2017. The same rate also dropped in Haiti, from 3.74 to 1.10 cases per 100,000 population between 2016 and 2017, respectively.

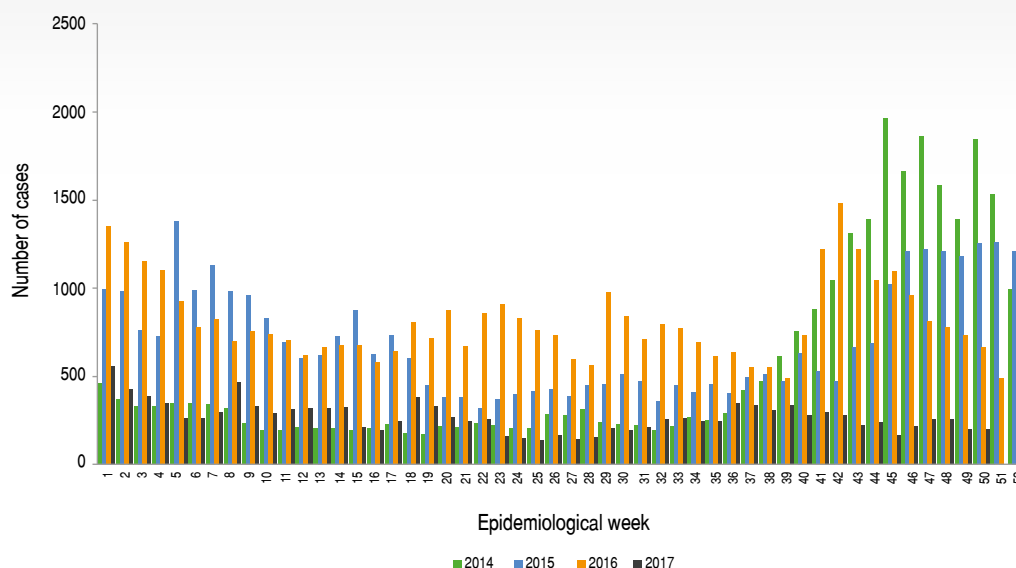
Dominican Republic. Between EW 1 and EW 50 of 2017, 119 suspected cholera cases were reported, representing 90% fewer than in 2016 (1,149 cases between the EW 1 and EW 52). Deaths were also significantly reduced (85%) in 2017 compared to 2016.

Haiti. The reported number of cases between EW 1 and EW 50 of 2017 (13,468) reflected a reduction of 68% when compared to cases reported in EW 1 through EW 52 of 2016 (41,421). The number of cases in 2017 is the lowest since the onset of the cholera outbreak in Haiti in October 2010 (Figure 4). Even so, from 200 to 300 suspected cases per week were still being reported. In EW 47 through EW 50 of 2017, suspected cases were reported in 7 of the 10 departments of the country, although four departments (Artibonite, Centre, Nord Ouest, and Ouest) concentrated 90% of cases. The average number of cases reported in that period was higher than in previous weeks, mainly due to higher incidences in the Nord and Nord Ouest departments, where an increase in 36% and 19% was observed, respectively.

Comparatively, between 2016 and 2017, the number of deaths from cholera decreased by 65% (from 447 to 157). The number of deaths notified in 2017 is the lowest since the outbreak began in 2010.

⁹ PAHO/WHO. Epidemiological Update: Cholera. 28 December 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2FCPNIL>

Figure 4. Number of suspected cholera cases, by EW, and by year, Haiti, 2014 to EW 50 of 2017



Source: Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Épidémiologie de Laboratoire et de Recherches (DELRL).

Table 1. Reported cholera cases and deaths, and case-fatality rate, Haiti and the Dominican Republic, by year, 2010-2017

Year	Haiti			Dominican Republic		
	Cases	Deaths	CFR (%)	Cases	Deaths	CFR (%)
2010‡	179.379	3.990	2,2	191	-	-
2011‡	340.311	2.869	0,8	20.851	336	1,6
2012‡	112.076	894	0,8	7.919	68	0,8
2013‡	58.809	593	1,0	1.954	42	2,1
2014‡	27.753	296	1,1	603	11	1,8
2015	36.045	322	0,9	546	15	2,7
2016	41.421*	447*	1,1	1.159*	27*	2,3
2017	13.468 ±	157±	1,2	119€	4€	3,4

Source: WHO, Weekly Epidemiological Bulletins. Available at: <http://www.who.int/wer/en/>

‡Data up to EW 52 of 2016.

€Data up to EW 50 of 2017. Dominican Republic Ministry of Public Health, General Directorate of Epidemiology.

*Data up to EW 50 of 2017. Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Épidémiologie de Laboratoire et de Recherches (DELRL).

Recommendations to Member States

During the year, PAHO/WHO reiterated the need for Member States to maintain cholera surveillance capacity for early detection of suspected cases, rapid laboratory confirmation of the diagnosis, and adequate treatment to save lives. With early and adequate treatment, the CFR of hospitalized patients should remain below 1%.

PAHO/WHO encouraged Member States to continue their efforts to guarantee adequate basic sanitation, access to drinking water, and safe food consumption, to reduce the risk of cholera

and other water-borne diseases. To this end, hygiene measures will have to be promoted, with the support of social mobilization.

Sources of Information

1. Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Epidémiologie de Laboratoire et de Recherches (DELR). Available at: <http://mspp.gouv.ht/site/downloads/Profil%20statistique%20Cholera%2050eme%20SE2017complet%20.pdf>
2. Dominican Republic Ministry of Public Health. Weekly Epidemiological Bulletin, EW 52 of 2016 and EW 14 and EW 50 of 2017. Available at: http://digepisalud.gob.do/documentos/?drawer=Boletines%20epidemiol%C3%B3gicos*Boletines%20semanales*2016
3. Dominican Republic Ministry of Public Health. Weekly Epidemiological Bulletin, EW 14 and EW 50 of 2017. Available at: <http://digepisalud.gob.do/docs/Boletines%20epidemiol%C3%B3gicos/Boletines%20semanales/2017/Bolet%C3%ADn%20Semanal%2014-2017.pdf>

Related links

- WHO. Weekly Epidemiological Record, vol. 91, EW 38 of 2016. 2015 Annual Cholera Report. Available at: <http://apps.who.int/iris/handle/10665/250142>
- WHO Cholera Fact Sheet. Available at: <http://www.who.int/mediacentre/factsheets/fs107/en/index.html>
- PAHO Health Topics: Cholera. Available at: www.paho.org/cholera
- WHO statement relating to international travel and trade to and from countries experiencing outbreaks of cholera. Available at: <http://www.who.int/cholera/technical/prevention/choleratravelandtradeadvice231110.pdf>
- PAHO/WHO. Atlas of Cholera outbreak in La Hispaniola. Available at: http://new.paho.org/hq/images/Atlas_IHR/CholeraHispaniola/atlas.html
- WHO. Cholera epidemic outbreaks: evaluating the response and improving preparation. Available in Spanish at: http://www.who.int/topics/cholera/publications/cholera_outbreak/es/
- PAHO/WHO. Recommendations for the clinical management of cholera. Available at: <https://bit.ly/2jpR5bm>.



Conjunctivitis

16 June 2017¹⁰

As of EW 23 of 2017, five countries and territories of the Americas had reported conjunctivitis outbreaks: the Bahamas, Brazil, the Dominican Republic, Guadeloupe, and Martinique.

Bahamas. During May and June 2017, there was an increase in the number of cases of conjunctivitis reported, which reached a total of 240 cases. The increase was 28% above the number (187) reported during the same period of 2016.

Brazil. In the municipality of Humaita, state of Amazonas, an outbreak of conjunctivitis included 172 cases reported between 18 May and 6 June 2017.

Dominican Republic. Up to EW 21 of 2017, 66,626 cases of conjunctivitis had been reported, a 62% increase over the same period of 2016 (41,022 reported cases). The conjunctivitis outbreak began in EW 18 of 2017 and was ongoing by mid-June. Between EW 18 and EW 21, the provinces of Santo Domingo, Santiago and San Cristobal, in addition to the Distrito Nacional, had the greatest increase in the number of cases.

Guadeloupe. Since the end of 2016, an increase in the number of cases of conjunctivitis was reported; that number was higher than the epidemic threshold. Between EW 20 and EW 21 of 2017, the number of suspected cases significantly increased, with approximately 500 to 600 cases reported weekly, and a cumulative incidence of 20 per 10,000 population (eight times higher than expected for the that time of the year). The commune of Grand Bourg reported the greatest incidence, with 353 cases per 10,000 population, followed by the communes of Le Gosier, Pointe-à-Pitre, and Terre-de-Bas, with an incidence between 50 and 100 cases per 10,000 population. Laboratory tests performed on a set of samples from suspected cases were positive for enteroviruses.

Martinique. In EW 20 of 2017, the number of cases of conjunctivitis significantly increased, when 250 suspected cases were reported. The cumulative incidence of conjunctivitis between EW 20 and EW 21 was 10 cases per 10,000 population. The communes of Marin and François reported the highest incidence rates, with 41 and 35 cases per 10,000 population, respectively.

25 July 2017¹¹

As of EW 29 of 2017, 13 countries and territories of the Americas had reported increases in the number of cases of conjunctivitis. Countries reported in the previous section were joined

¹⁰ PAHO/WHO. Epidemiological Update: Conjunctivitis. 16 June 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2JrQn8B>

¹¹ PAHO/WHO. Epidemiological Update: Conjunctivitis. 25 July 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HuAmOz>

by Costa Rica, Dominica, Mexico, Panama, Saint Martin, Saint Lucia, Suriname, and Turks and Caicos Islands. In addition, Cuba reported cases in 2017.

Bahamas. Between the EW 18 and EW 23 of 2017, 240 cases of conjunctivitis were reported, 28% more than in the same period of 2016 (187 cases).

Brazil. In addition to the cases reported in the state of Amazonas, in EW 26 of 2017, an increase in the number of cases was recorded in the municipality of Porto Velho, state of Rondonia. Laboratory results indicated infection by adenovirus, enterovirus, and coxsackie virus. In EW 27, the municipality of Fernandopolis, state of Sao Paulo, also reported an increase in cases of conjunctivitis, with 325 cases occurring from the beginning of 2017, 49 of which were reported in EW 26. In EW 29 of 2017, the municipality of Santiago do Sul, state of Santa Catarina, reported a 40-case conjunctivitis outbreak, largely in the school-age population.

Costa Rica. The International Health Regulations (IHR) National Focal Point (NFP) reported to PAHO/WHO an increase in the number of cases of conjunctivitis in canton Garabito, Province of Puntarenas, with a cumulative number of 1,559 cases between EW 24 and EW 29 of 2017. The most affected age groups were 10 to 19 years, with 309 cases, and 30 to 39 years with 307 cases. The town of Herradura, Garabito canton, reported the highest incidence rate, 834 cases per 10,000 population, followed by the towns of Jaco Centro, Quebrada Ganado, Quebrada Amarilla, and Tarcoles, with an incidence rate of 300 to 700 cases per 10,000 population. There were seven laboratory samples analyzed, of which two were positive for enterovirus.

Cuba. As of EW 26 of 2017, a cumulative total of 1,427 cases of conjunctivitis had been reported in seven provinces and 46 municipalities. Guantanamo was the province reporting the highest number of cases, with 858, followed by Santiago de Cuba with 359, Havana with 154, Ciego de Avila with 35, and Tunas with 21 cases. Laboratory tests on samples of cases from Santiago de Cuba and Guantanamo were positive for Coxsackie A24 virus. The last known outbreak of conjunctivitis occurred in Cuba in 2003, when 171,910 cases were reported throughout the country.

Dominica. The IHR NFP reported a conjunctivitis outbreak occurring between May and June 2017. The outbreak affected the seven health districts and all age groups.

Dominican Republic. Up to EW 26 of 2017, 155,148 cases of conjunctivitis had been reported, for a rate of 152 cases per 10,000 population. The highest number of cases was reported in EW 22 of 2017. Among those that sought healthcare, the highest age-specific incidence rate occurred among children under 5 years of age.

Guadeloupe. From EW 20 to EW 27 of 2017, 9,700 cases of conjunctivitis were reported. In EW 26 and EW 27 of the same year, the number of suspected cases increased significantly, with 1,680 and 2,270 weekly cases reported, respectively, and a cumulative incidence rate of 65 per 10,000 population. In that period, the commune of Gourbeyre reported the highest incidence rate, with 187 cases per 10,000 population, followed by the Petit Canal and Pointe-à-Pitre communes, with an incidence of 182 and 154 cases per 10,000 population, respectively. Laboratory tests performed on 14 samples from suspected cases yielded 13 positive results for enterovirus, of which 5 were also positive for Coxsackie A24v virus.

Martinique. Between EW 19 and EW 27 of 2017, 15,670 suspected cases of conjunctivitis were reported. During EW 26 and EW 27 of the same year, the number of suspected cases decreased from 3,370 to 3,130 weekly cases reported, respectively, and a cumulative incidence of 150 cases per 10,000 population. The highest incidence rate was detected in the commune of Robert, with 370 cases per 10,000 population, and the communes of Lamentin et Diamant with 266 cases per 10,000 population. Laboratory tests on samples from suspected pediatric cases were positive for adenovirus and Coxsackie A24v virus.

Mexico. Between EW 1 and EW 26 of 2017, there was an increase in cases of conjunctivitis, with 163 cases of acute hemorrhagic epidemic conjunctivitis reported, as well as 611,850 cases of conjunctivitis. In comparison, in the same period of 2016, 59 cases of acute hemorrhagic epidemic conjunctivitis and 494,709 cases of conjunctivitis had been reported. Except for Campeche, Colima, Chiapas, Durango, Nayarit, and Sonora, all states reported an increase in the number of cases of conjunctivitis.

Panama. In EW 27 of 2017, the IHR NFP reported an outbreak of conjunctivitis in the province of Colon. The outbreak started in the district subdivisions of Palmas Bellas and Achiote, and subsequently spread to the rest of the province and to at least nine other health regions of the country. As of EW 29 of 2017, 411 cases had been reported in the province of Colon. The age groups that concentrated the highest number of cases (41%) were from 25 to 34 years (77 cases), and from 35 to 49 years (91 cases). Enterovirus was isolated from a patient sample.

Saint Lucia. In EW 28 of 2017, the Ministry of Health and Welfare reported an increase in cases of conjunctivitis. The cases were reported by both the public and private sectors, in all regions of the country. A total of 47 cases were reported in July of 2017, in comparison with two cases reported in June of the same year.

Saint Martin. Between EW 22 and EW 27 of 2017, 1,380 suspected cases of conjunctivitis were reported. Between EW 26 and EW 27 of 2017, the number of suspected cases continued to rise, with 160 to 350 cases reported weekly, respectively.

Suriname. The IHR NFP reported an increase in suspected cases of conjunctivitis starting in EW 18 of 2017, with a maximum of 1,333 cases reported in EW 20 of 2017. Cases were detected in all 10 districts of Suriname. Laboratory tests conducted in samples of suspected cases were positive for Coxsackie A24 virus.

Turks and Caicos Islands. In EW 23 of 2017, the Ministry of Health, Agriculture and Human Services reported an increase in the number of cases of conjunctivitis and called upon the population to intensify hygiene measures to reduce transmission.

Recommendations

Considering the increase in conjunctivitis transmission in some countries and territories of the Region, PAHO/WHO emphasized the need to strengthen surveillance and implement recommendations to control the spread of the disease. Following are the main recommendations related to surveillance, prevention, management of contacts, and case management.

Surveillance and epidemiological investigation

- Enhance surveillance for the timely detection of outbreaks, to adequately orient control measures.
- Promptly notify health authorities upon detection of an outbreak.
- Investigate contacts and sources of infection and determine if there has been a common source of infection.
- Strengthen laboratory capacity for confirmation of diagnosis.
- Disseminate information and recommendations to healthcare workers.

Prevention measures, management of contacts and of the immediate environment

- Promote hand washing, as well as meticulous cleaning and handling of any object that may come into contact with ocular or respiratory secretions.

- Ensure the cleanliness of conjunctival exudates.
- Conduct health education campaigns for cases and contacts to avoid overcrowding and promote hygienic measures; instruct on the need to avoid touching eyes with hands or any object, and to frequently wash hands. Patients should not share any utensils and personal belongings with the rest of their families.
- Properly chlorinate pools.
- Organize diagnostic and case management services.
- Ensure adherence to asepsis and antisepsis standards in health care settings.

Healthcare workers

- Always wear gloves and gowns for patient care and use personal protective measures.
- Wash hands after providing care to an individual with probable or laboratory confirmed conjunctivitis.
- Disinfect furniture and medical equipment to avoid contamination of other patients and/or staff.

Case management

- The management of conjunctivitis is symptomatic and should be limited to general measures, such as cold compresses and artificial tears with vasoconstriction.
- Antimicrobial agents should not be indicated, unless there is an aggregate microbial infection. The effectiveness of antiviral drugs has also not been demonstrated.
- Steroidal anti-inflammatory medications should not be used as they significantly increase viral replication. Eye drops containing antibiotics should not be used.
- Isolation should be used to limit contact with cases during the active period of the disease; take precautions regarding exudates and secretions. Restrict contact with cases while the disease is active.

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Diphtheria

22 August 2017¹²

In the first 32 EWs of 2017, three countries of Region of the Americas reported suspected and confirmed cases of diphtheria: Brazil (1 case), Haiti (80 cases), and Venezuela (123 cases). In 2016, there were a total of 78 confirmed cases, also in three countries: the Dominican Republic (2 cases), Haiti (56 cases), and Venezuela (20 cases). In 2015, there were 49 confirmed diphtheria cases in five countries: Brazil (12 cases), Canada (3 cases), the Dominican Republic (1 case), Guatemala (1 case), and Haiti (32 cases).

Following is a description of the situation in countries with reported cases of diphtheria in 2017.

Brazil. In EW 30 of 2017 a case of diphtheria was confirmed in the state of Roraima; the case probably contracted the infection in Venezuela. There were no secondary cases.

Haiti. Between EW 1 and EW 30 of 2017, 72 probable cases of diphtheria were reported. Of those, 74% were less than 10 years old and 60% were female. Regarding vaccination status, 18.2% of the cases had been vaccinated, 27.3% were not vaccinated; the vaccination status of 54.5% of cases was unknown. Of all cases, 22 were laboratory confirmed, including 3 deaths. Confirmed cases came from four departments: Artibonite, Centre, Ouest, and Sud Est.

Venezuela. Between EW 28 of 2016 and EW 24 of 2017, there were 447 suspected cases of diphtheria reported (324 in 2016 and 123 in 2017), of which 51 were laboratory-confirmed, including 7 deaths in the following departments: Anzoategui (2); Bolivar (1); Monagas (3), and Sucre (1). The cumulative CFR among confirmed cases was 20%. Seventeen federal entities reported cases: Anzoategui (37 cases), Apure (19 cases), Barinas (2 cases), Bolivar (282 cases), Carabobo (1 case), Cojedes (6 cases), Capital District (9 cases), Merida (3 cases), Miranda (29 cases), Monagas (26 cases), Nueva Esparta (1 case), Portuguesa (2 cases), Sucre (10 cases), Trujillo (3 cases), Vargas (5 cases), Yaracuy (4 cases), and Zulia (8 cases). Of the 51 laboratory-confirmed cases, 55% were female and 47% were between 5 and 19 years old. Concerning the vaccination status of confirmed cases, 78% had incomplete vaccination records, and 15% were not vaccinated. For 7% there was no vaccination status information.

15 November 2017¹³

As of this date, five countries of the Region had reported suspected or confirmed cases of diphtheria: Brazil, Colombia, the Dominican Republic, Haiti, and Venezuela.

¹² PAHO/WHO. Epidemiological Update: Diphtheria. 22 August 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HiaG7J>

¹³ PAHO/WHO. Epidemiological Update: Diphtheria. 15 November 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HMIDzj>

Brazil. Up to EW 44 of 2017, 39 suspected cases of diphtheria had been reported in 13 states. Of that total, 5 cases were confirmed: 1 by laboratory, 1 by clinical-epidemiological criteria, and 3 by clinical criteria. Regarding the vaccination status of confirmed cases, the one laboratory-confirmed case and another two were not vaccinated. Two had their full vaccination schedule.

The age of confirmed cases ranged from 4 to 51 years; three were male and two female. There was a single fatal case, the one with laboratory confirmation that was imported from Venezuela. Secondary cases related to this case were not reported, nor were there new imported cases in the country.

Colombia. Between EW 1 and EW 43 of 2017, 14 suspected cases of diphtheria were reported, but were subsequently discarded by laboratory.

Dominican Republic. Between EW 1 to EW 43 of 2017, 3 confirmed cases of diphtheria were reported, 1 in EW 12, the second in EW 32, and the third, in EW 43. All the cases evolved favorably, and no deaths from this cause were reported.

Haiti. Between EW 1 and EW 43 of 2017, 120 probable cases of diphtheria were reported, of which 51 were laboratory-confirmed. Seven of those cases died. Among the cases confirmed, 82% were 5 years of age and older and 53% were female. As for vaccination status, 26% of confirmed cases had been vaccinated, 33% were not vaccinated, and 41% did not know or had no information on their vaccination status. Twenty-two communes reported confirmed cases in 2017, 9 fewer than in 2016. Most confirmed cases were from the Ouest (39%) and Artibonite (33%) departments.

Venezuela. Up to EW 42 of 2017, 511 probable cases of diphtheria were reported. Samples were obtained from 452 of cases (88.5%), of which 146 (32.3%) were laboratory-confirmed (69 by bacterial isolation and determination of toxin production by Elek test, and 38 by PCR). All 17 federal entities continued to be affected. The most affected age group was between 5 and 19 years of age (54.3%), and 51% were female.

According to reports provided by the national authorities, between January and September 2017, the vaccination coverage of infants (< 1 year of age) with pentavalent vaccine was 67.8%, and boosters had been administered to 41.9% of 5-year-olds. The vaccination coverage of pregnant women was 49.2%, and among schoolchildren, 68.3%.

In response to the epidemiological situation, the Venezuela Ministry of the Popular Power for Health intensified vaccination against diphtheria as a part of the national vaccination plan, for which there were 9 million doses of vaccine. Intensified epidemiological surveillance was maintained, as well as active case-finding, case investigation, and contact tracing.

15 December 2017¹⁴

As of this date in 2017, confirmed cases of diphtheria had been reported in Brazil, the Dominican Republic, Haiti, and Venezuela.

Brazil. Up to EW 49 of 2017, 42 suspected cases of diphtheria had been reported in 14 states. Of those, 4¹⁵ were confirmed, 1 each in the following states: Acre, Minas Gerais, Roraima, and Sao Paulo (1 by laboratory and 3 by clinical criterion). Two cases had not been vaccinated (including the laboratory-confirmed case), and the other two had incomplete vaccination schedules. The age of confirmed cases was between 4 and 51 years; three were males and 1 female. There was

¹⁴ Pan American Health Organization / World Health Organization. Epidemiological Update: Diphtheria. 15 December 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2K4bxuA>

¹⁵ One case previously confirmed by clinical criteria was discarded by laboratory.

a single fatal case, the one laboratory-confirmed case that had been imported from Venezuela. No secondary cases nor additional imported cases were reported in the country.

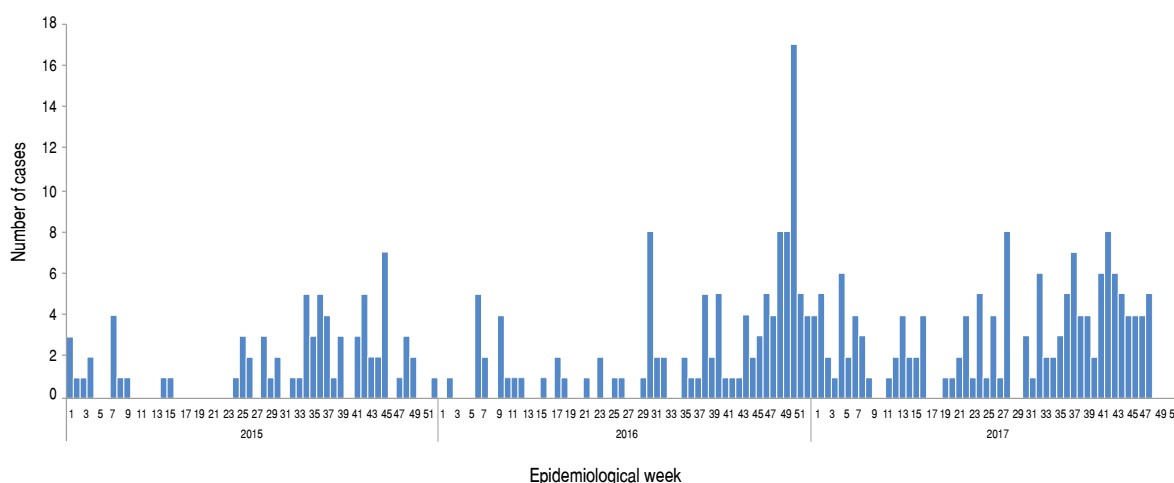
Dominican Republic. The Ministry of Public Health and Social Assistance reported that of the three cases of diphtheria confirmed and reported in the PAHO/WHO 15 November 2017 Epidemiological Update, only one had been confirmed as diphtheria. The other two were discarded, one by clinical criteria, and the other by laboratory tests. All the cases evolved favorably, and no deaths from diphtheria occurred.

Haiti. The outbreak that began at the end of 2014, remained active at the end of 2017, with a total of 348 probable cases of diphtheria reported, including 46 deaths, as of EW 48 of 2017. In the last quarter of the year, there was an increase in the number of cases, when compared to previous quarters (Figure 5). Between EW 1 and EW 48 of 2017, there were 152 probable cases reported, with a 10% CFR. Of all probable cases, 59% were female and 76%, less than 10 years of age. Of those cases, 11% had been vaccinated; 89% did not have information on vaccination status. The departments of Artibonite and Ouest reported 38% and 33% of all probable cases, respectively, like in 2016, when 70% of all reported cases were detected in those departments.

Samples were obtained from 141 of the 152 probable cases reported in 2017; of those 64 (45%) were laboratory confirmed for diphtheria, 52 were discarded, and 25 were pending. Of the confirmed cases, 81% were from the departments Artibonite and Ouest.

Epidemiological surveillance was intensified in the country to detect populations at risk; public health measures were implemented, among others, a vaccination campaign planned for the beginning of 2018.

Figure 5. Probable cases of diphtheria, by EW, Haiti, 2014 to EW 48 of 2017



Source: Data provided by Ministère de la Santé Publique et de la Population (MSPP) de Haïti/ Direction d'Epidémiologie de Laboratoire et de Recherches (DELR), and reproduced by PAHO/WHO.

Venezuela. Between EW 28 of 2016 and EW 48 of 2017, a diphtheria outbreak that began in the Sifontes municipality, state of Bolivar, had spread to 21 other states. There were 933 probable cases of diphtheria reported, 324 of them in 2016. Between EW 1 and EW 48 of 2017, 609 probable cases of diphtheria were reported (CFR 21%), of which 227 were laboratory-confirmed by PCR. Of 198 confirmed cases, 14% had vaccination history, and 56% were female. Most cases (72%) occurred among those aged ≥ 11 years.

The Venezuela Ministry of the Popular Power for Health intensified vaccination activities in the municipalities with cases, and planned a vaccination campaign for early 2018. Strengthening epidemiological surveillance, active case-finding, contact tracing, and the diagnostic capacity were implemented.

Recommendations

PAHO/WHO advised Member States to continue their efforts to ensure high vaccination coverage, using strategies that allow them to reach appropriate levels in all their territorial entities. In an outbreak involving adults, the groups most affected and most at risk should be immunized.

PAHO/WHO also recommended Member States strengthen surveillance systems for early detection of suspected cases, to initiate timely treatment of cases and contacts, including the provision of diphtheria antitoxin (DAT).

PAHO/WHO reminded Member States that adequate clinical management is key to reducing complications and mortality. Following are the case management recommendations for health authorities.

Clinical management

If diphtheria is strongly suspected, specific treatment with antitoxin and antimicrobials should be initiated immediately. It is not necessary to wait for laboratory results to initiate treatment.

Equine-derived DAT is highly effective and is the gold standard for diphtheria treatment. To reduce complications and mortality, DAT should be administered as soon as possible after disease onset, preferably intravenously in serious cases.

The entire therapeutic dose should be administered in a single dose, immediately after throat swabs have been taken. The amount of antitoxin recommended varies between 20,000 and 100,000 units, with larger amounts recommended for persons with extensive local lesions and with longer interval since onset. The dose is the same for children and adults. Adverse events such as anaphylaxis may occur.

Antimicrobials are necessary to eliminate the organism and prevent spread; however, they are not a substitute for antitoxin treatment.

Management of contacts

Close contacts include household members and other persons with a history of direct contact with diphtheria patients, as well as healthcare workers exposed to the oral or respiratory secretions of patients.

All close contacts should be clinically assessed for symptoms and signs of diphtheria and kept under daily surveillance for 7 days from the last contact. Adult contacts must avoid contact with children and must not be allowed to handle food until proven not to be carriers.

All contacts must receive a single dose of benzathine benzylpenicillin intramuscularly (600,000 units for children under 6 years, 1.2 million units for those 6 years or older). If the culture is positive, antimicrobials should be given as outlined above.

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Malaria

15 February 2017¹⁶

In 2016, malaria transmission intensified significantly in endemic municipalities of some countries of the Region of the Americas. In addition, there was an increase in the number of cases of *Plasmodium falciparum* malaria in some endemic foci. In view of this, PAHO/WHO warned of the risk of outbreaks, of an increase in malaria transmission in endemic areas, as well as of the potential reintroduction of the disease in places where transmission had been interrupted. PAHO/WHO urged Member States to strengthen surveillance and control activities, and, especially, to continue to address the barriers that create detection delays or failures, and impede case treatment and follow-up.

In 2015, a total of 451,242 cases of malaria were reported in the Region, representing a decrease of 62% compared with cases reported in 2000, but representing a 16% increase than in 2014, the year with the lowest number of malaria cases of the last four decades. Of 21 endemic countries, 8 reported an increase in the number of cases when compared to the previous year: Colombia, the Dominican Republic, Ecuador, Guatemala, Honduras, Nicaragua, Peru, and Venezuela.

In 2016, the rising trend continued in some countries. Colombia, Ecuador, and Venezuela reported an increase cases of malaria, as well as in the proportion of cases by *Plasmodium falciparum* in comparison to those by *P. vivax*. In addition, Honduras and Peru reported an increase in the proportion of cases by *P. falciparum* in the country's main areas of transmission.

Although the prevalence of *P. falciparum* in some countries is conditioned by the racial composition of the population in affected areas, the increase in the proportion of *P. falciparum* cases may indicate deterioration of the response capacity, both to provide treatment and to implement vector control measures. This is important, because the increase in the number of cases by *P. falciparum* indicates a greater risk of malaria complications.

Malaria case reporting in Costa Rica and Cuba in EW 48 of 2016 and EW 2 of 2017, respectively, highlighted the risk of introduction and the importance of maintaining functional early warning and response systems in local health services.

The increase in malaria transmission in some countries of the Region may be related to environmental phenomena that have historically determined a cyclical epidemic behavior of the disease in the Americas. However, in 2015 and 2016, social and economic factors, such as mining and increased migration flows in areas with ecosystems favorable to malaria transmission, determined the behavior of the disease in the Region. The weakening malaria diagnosis networks was another factor in the malaria trends in the past two years.

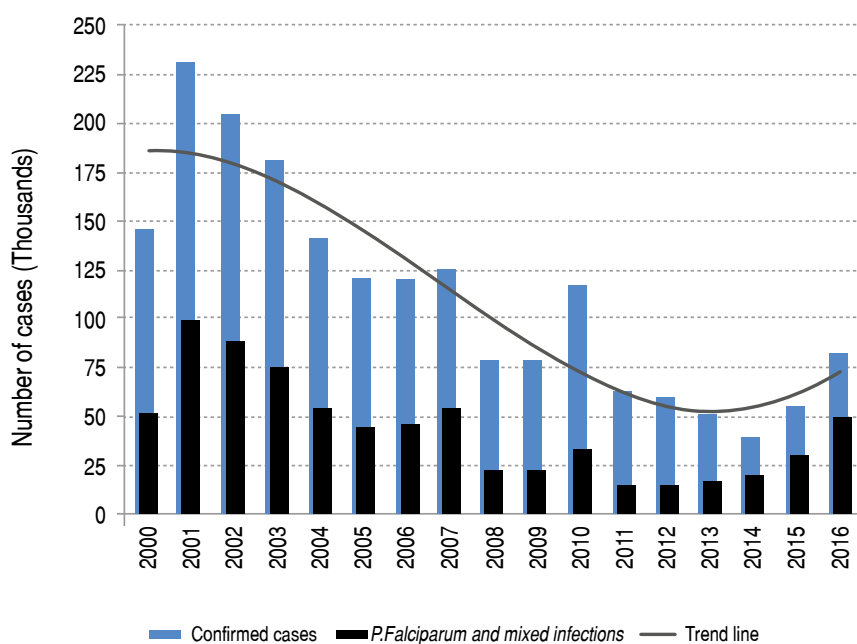
¹⁶ PAHO/WHO. Epidemiological Alert: Increase in cases of malaria. 15 February, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2qV21kr>

The risk of introducing *P. falciparum* malaria and of disseminating strains of this *plasmodium* with varying antimalarial resistance profiles is affected by population movements within and between countries. In this regard, special attention must be given to the risk of introducing *P. falciparum* strains from South America to places with favorable ecosystems in Central America and the Caribbean.

A summary of the malaria situation in selected countries of the Region is summarized below.

Colombia.¹ Between EW 1 and EW 52 of 2016, 83,356 cases of malaria were reported; of those, 57% (47,497) were *P. falciparum* malaria, 39.7% (33,055) *P. vivax*, and 3.3% (2,804) were mixed infections. Up to 2013 most cases had been caused by *P. vivax* (66%, n=33,345), starting in 2014 that proportion shifted and currently the highest proportion of cases are caused by *P. falciparum*. The number of *P. falciparum* cases plus mixed infections (49,533) reported in 2016 was higher than the number reported in the last 5 years (Figure 6). Ninety-four percent (46,652) of the *P. falciparum* and mixed infection cases were reported in five territorial entities: Choco (62%), Nariño (21%), Antioquia (5%), Buenaventura (3%), and Cauca (3%).

Figure 6. Malaria cases reported by year, Colombia. 2000 to 2016



Source: Data from 2000 to 2014 were retrieved from the PAHO/WHO Report on the Situation of Malaria in the Americas 2014. Data for 2015 were obtained from the WHO 2016 World Malaria Report. Data for 2016 were published by the Colombian National Institute of Health, Weekly Epidemiological Bulletin, EW 52 of 2016

Costa Rica. In EW 48 of 2016, the IHR NFP reported to PAHO/WHO two autochthonous cases of *P. vivax* malaria in the Province of Limon, Canton Matina, District Carrandi, Saborio locality. Both cases occurred following a period of three years with no autochthonous cases reported in the country. They were isolated cases without history of recent travel abroad. Additionally, in EW 50 of 2016, two new autochthonous cases were reported in the locality of Saborío. To date, new cases had not been reported.

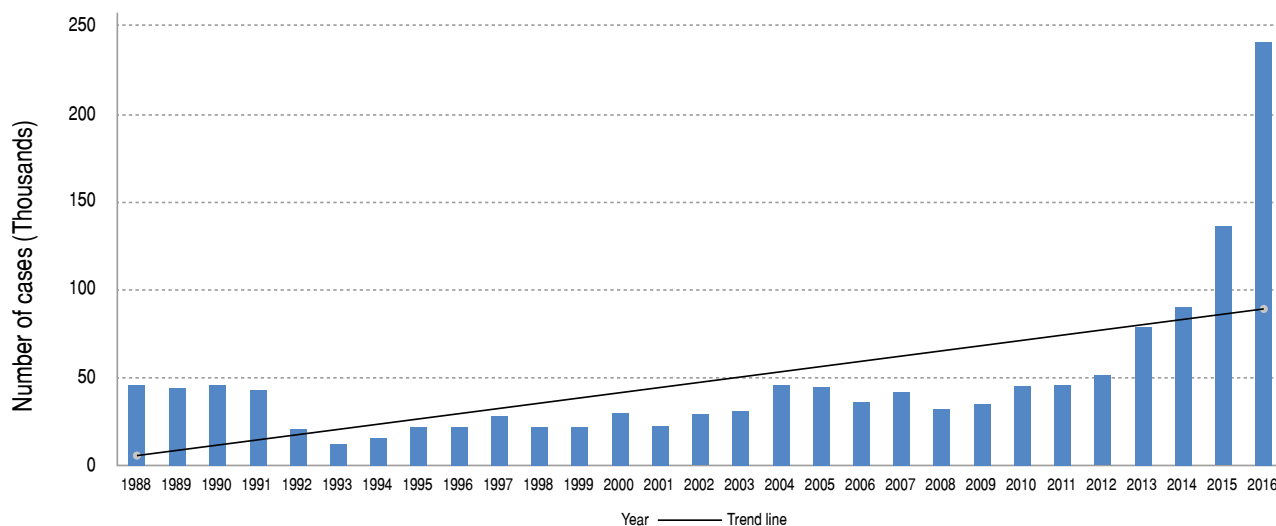
Cuba. In EW 2 of 2017, the IHR NFP notified PAHO/WHO of two confirmed autochthonous cases of *P. vivax* malaria in the municipality of Rodas, province of Cienfuegos, related to an imported case from Guyana. In 2016, there were 71 imported cases of malaria reported, of which 66% (47) were classified as *P. falciparum*, 31% (22) as *P. vivax* and 3% (2) as *P. malariae*.

Ecuador.² Between EW 1 and EW 52 of 2016, 926 cases of malaria were reported, of which 69% (639) were by *P. vivax* and 31% (287) by *P. falciparum*. As of EW 17 of 2016, there was an increase in the number of malaria cases compared to 2014 and 2015. The four provinces with the highest number of cases reported during 2016 were Morona Santiago, with 38% (355), followed by Pastaza, with 24% (220), Orellana, with 17% (159) and Esmeraldas, with 14% (126) of all cases.

There was also an increase in the number of reported cases of *P. falciparum* malaria when compared to 2015. Forty-nine percent of those cases (142) occurred in the provinces Morona Santiago and Pastaza, in the eastern part of the country. This represents a significant increase in those provinces, which reported 8 cases of *P. falciparum* malaria each in 2015.³ Per the Ministry of Public Health, the increase in 2016 could be the result of increased migratory activity in border area communities.

Venezuela. Starting in 2010, an increase in the number of cases of malaria was observed. The IHR NFP reported there were 240,613 cases in 2016, representing 76% more than in the same period of 2015 (136,402 cases) (Figure 7). Of those cases, 75% (179,554) were caused by *P. vivax*, 19% (46,503) by *P. falciparum*, and 6% (14,531) were the result of mixed infections. Cases occurred in 16 of the 24 entities of the country; with the municipality Domingo Sifontes, in the state of Bolivar, concentrating the highest number of cases (43% of the total); the epidemic related to the boom in gold exploitation and the movement of people from other states and countries who settle in conditions conducive to malaria transmission.

Figure 7. Number of reported cases of malaria, by year, Venezuela, 1988 to EW 32 of 2016



Source: Venezuela IHR NFP and reproduced by PAHO/WHO

Recommendations

PAHO/WHO warned Member States of the risk of outbreaks, increases in the number of cases and deaths in endemic areas, as well as a potential reintroduction of the disease in areas where transmission was previously interrupted. Achievements on the path to eliminating the disease in the Region can be compromised if disease monitoring and control actions are not maintained or strengthened.

PAHO/WHO urged countries to strengthen measures for early detection and treatment based on parasitological diagnosis. The main intervention to control malaria is to shorten the time between the onset of symptoms, treatment, and investigation and response actions.⁴

PAHO/WHO recommended strengthening surveillance and case detection in health care units, and active case tracing among at risk populations in known areas of transmission.

Understanding local transmission dynamics will allow the optimization of case search efforts. In areas where transmission is low, the occurrence of new cases should trigger epidemiological investigations of each case, to determine whether it is imported, introduced, or autochthonous. Conducting the investigation within a few days of diagnosis is essential to guide a rapid response, including a timely interruption of transmission. In this context, a reactive search of cases, i.e., the investigation and sample taking from people living with or related to the case or the conglomerate of cases, is an essential measure of the response.

PAHO/WHO urged Member States to ensure the quality of parasitological diagnosis and prevent a shortage of medicines. Drug management and case management policies should address the risk of introducing chloroquine resistant strains of *P. falciparum*, as well as the permanent availability of drugs, and staff training to treat severe malaria.

Vector control interventions should complement case detection and case management. In-home residual spraying and massive use of impregnated mosquito nets are key interventions of malaria vector control. Measures that mainly affect mosquito survival (intra-domiciliary residual spray and mosquito nets impregnated with insecticide) have a greater impact on the interruption of transmission than those actions that seek to reduce vector density,⁵ such as larval control and spatial insecticide application. Malaria Larval control is applied in situations where mosquito breeding sites are permanent or semi-permanent, can be easily identified and accessed, and where the density of human populations is enough to justify the resources required by this type of measure.⁶ Spatial insecticide applications are not currently recommended due to their limited effect on malaria control.⁷

Malaria control in active transmission area and preventing the spread of the disease require active epidemiological surveillance of the determinants and social phenomena that condition transmission (movements of population due to economic activities, agricultural or mining undertakings), as well as the mobilization of other stakeholders in interventions adapted to the context of affected populations.

PAHO/WHO also urged national malaria programs and others in the ministries of health to coordinate their national responses, to address local barriers that may be determining delays in case detection, treatment, and follow up. Reducing the burden of disease and the risk of transmission in the national level depends on malaria control in major areas of transmission. PAHO/WHO emphasized the need for Member States to continue to work to achieve the goals of the *Plan of Action for the Elimination of Malaria 2016-2020*, related to the interruption of local transmission, and reduction of the incidence of cases and associated mortality.

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Measles

Since the Region of the Americas was the first to be declared free from rubella and measles by an International Expert Committee in 2015 and 2016, respectively, it is crucial to maintain such achievements. The main measure to prevent the introduction and spread of those viruses is the vaccination of susceptible populations, together with a high-quality surveillance system that is sensitive enough to timely detect any suspected case of measles or rubella.

Considering that measles and rubella viruses still circulate in other continents; that the arrival of international travelers in the Americas increased 4% in 2016, mainly in South America (7%) and Central America (6%), and that the vacation season was upcoming in the countries of the northern hemisphere, cases among unvaccinated travelers were expected. Thus, PAHO/WHO reiterated its recommendations to health authorities regarding the prevention and response to imported measles cases.

4 May 2017¹⁷

Considering the increase in reported measles cases in Europe, PAHO/WHO recommended Member States strengthen surveillance activities and implement adequate measures to protect their population against measles and rubella, and keep the Region free of both diseases.

Situation in the Americas

During 2016, 93 confirmed cases of measles were reported in three countries of the Region (Argentina, Canada, and the United States), and the regional incidence rate of confirmed cases of measles was the lowest in the history of the disease in the continent (0.093/1,000,000 inhabitants). However, that same year, there was a significant decrease in the reporting rate of suspected cases, which reached its lowest point, at 1.9 per 100,000 population. That decline is a reminder that maintaining high reporting rates for suspected cases of measles and rubella will allow timely detection of imported cases.

Between EW 1 and EW 17 of 2017, 84 confirmed cases were reported in the Region: 2 in Argentina, 39 in Canada, and 43 in the United States. All confirmed cases in 2016 and 2017 were imported from other regions of the world. Following, are the main characteristics of confirmed cases reported in the Americas during 2017, according to available information:

- From the total, 37 cases (47%) had been vaccinated and 31 (40%) had not been vaccinated. In 16 cases (19%) the vaccination status was unknown or there was no information on the vaccination history.

¹⁷ PAHO/WHO. Measles Epidemiological Update, 4 May 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2FmQLTq>

- Of the 76 reported cases with information on age, 37 (49%) were between 15 and 39 years old.
- Of the 73 with information on sex, 43 cases (59%) were men.
- Of the 46 cases with information on probable place of infection, 57% (26 cases) came from India.
- The genotypes identified were D8 in Argentina, B3 and D8 in Canada, and D8, B3 and H1 in the United States.

Situation in other regions

Europe

Between early January 2016 and 1 May 2017, 7,847 cases of measles were reported by 37 countries in the WHO European Region. Of those, 34% were reported in 2017, and the majority were from Romania (3,181 cases), and Italy (1,549 cases). Both countries reported a high number of cases. The following, are the main characteristics of the European outbreaks occurring during the first few months of 2017:

- Of 4,646 cases with information on vaccination history, 87% had not been vaccinated.
- Of 5,101 cases with information on age, 31% were children aged 1 to 4 years, and 27% were adults over 20 years of age.
- The genotypes identified were D8 (669 cases), B3 (323 cases), H1 (28 cases), and D4 (2 cases).
- During that period, 25 deaths were reported in four European countries: 1 in Portugal, 22 in Romania, 1 in Switzerland, and 1 in the United Kingdom.

Other regions

China, Ethiopia, India, Indonesia, Lao People's Democratic Republic, Mongolia, Nigeria, the Philippines, Sri Lanka, Sudan, Thailand, and Viet Nam also reported measles outbreaks in 2016 and 2017.

22 September 2017¹⁸

From early January 2016 through the late July 2017, countries of the WHO European Region had reported 14,591 confirmed cases of measles. Of those, 64% (9,386) were reported in 2017. In the first six months of that year, most of the cases were reported by Italy (3,660), Romania (1,844), and Ukraine (943). The measles diagnosis was confirmed by laboratory (serology, virus detection or isolation) in 57% of the cases; by epidemiological link in 24%; and by clinical symptoms in 19%. The genotypes identified were D8 (405), B3 (547), H1 (22), and D9 (1).

Of all the cases with information on age (9,384), 3,972 (42%) were ≥ 20 years old, while 2,024 (22%) were between 1 and 4 years of age. Furthermore, of all the cases with known vaccination history (7,840), 84% had not been vaccinated, and 17% had received a single dose of the measles vaccine. The suboptimal vaccination coverage in many of these countries has favored the spread of measles.

¹⁸ PAHO/WHO. Measles Epidemiological Update, 22 September 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HxTefu>

Outbreaks of measles reported in other continents in 2016 and 2017 remained the same as previously reported.

Situation in the Americas

Between EW 1 and EW 37 of 2017, 167 confirmed cases of measles were reported in three countries of this Region: Argentina (3 cases), Canada (45 cases),¹⁹ and the United States (119 cases).¹⁹ All confirmed cases were imported from other continents, related to importation or had unknown source of infection. Of confirmed cases, 36% were children between 1 and 4 years of age, and 32%, adults between 20 and 49 years of age. Of the cases with information on sex and vaccination status, 52% were female, and 60% had not been vaccinated. The genotypes identified in those outbreaks were D8 in Argentina, and B3 and D8 in Canada and the United States.

Venezuela. Between EW 26 and EW 35 of 2017, 84 suspected measles cases were reported in 10 parishes of the municipality of Caroni, state of Bolivar, Venezuela. Of the total, 34 cases were laboratory-confirmed, 42 were under investigation, and 8 were discarded. Of confirmed cases, 79% (27) were 9 years of age or younger.

Measures adopted by the Venezuela public health authorities included:

- Identification and investigation of all suspected cases.
- Activation of the situation room at regional and national levels.
- Intensification of epidemiological surveillance and case-finding of contacts, to establish an effective epidemiological barrier.
- Collection of serum and nasopharyngeal swab samples from suspected cases.
- Mass indiscriminate vaccination against measles, mumps, and rubella (MMR) of the population aged 6 months to 10 years, and selective vaccination of contacts between 11 and 39 years of age (depending on the age group of the affected population).

PAHO/WHO collaborated with national authorities in the implementation of such measures. Furthermore, it assisted in training institutional and community healthcare workers, on the detection and investigation of suspected cases, and in the acquisition of supplies, reagents, and vaccines to respond to the outbreak.

27 October 2017²⁰

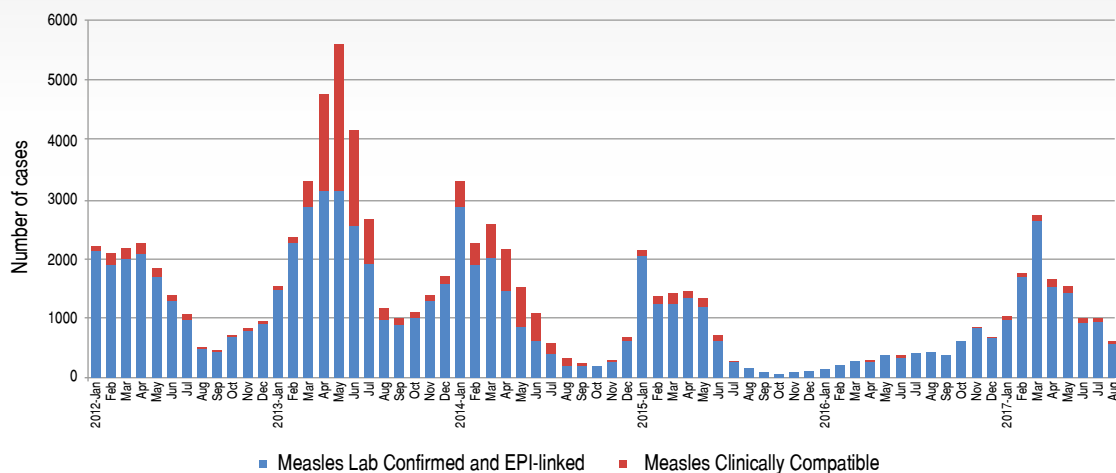
Situation in Europe

Between September 2016 and August 2017, countries of the WHO European Region reported 15,516 confirmed cases of measles, of which 83% (12,921) were reported in 2017 (Figure 8). In that period, the greatest incidence was recorded in Romania (259 cases per 1 million population), Italy (80.5 cases per 1 million population), and Tajikistan (77 cases per 1 million population). In 2017, the measles diagnosis was laboratory-confirmed (serology, viral detection or isolation) in 55% (7,152) of the cases; the rest were confirmed by epidemiological link or clinically. Identified genotypes were D8 (405), B3 (547), H1 (22), and D9 (1).

¹⁹ Provisional data.

²⁰ Pan American Health Organization / World Health Organization. Measles Epidemiological Update, 27 October 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HvSNCK>

Figure 8. Number of measles cases per month of onset of rash, WHO European Region, January 2012 to August 2017



Source: WHO Regional Office for Europe, Vaccine-preventable Diseases and Immunization Program

Countries in other continents also reported measles outbreaks in 2016 and 2017, as indicated in previous paragraphs.

Region of the Americas

Between EW 1 and EW 41 of 2017 168 cases of laboratory-confirmed measles were reported in three countries of the Region: Argentina (3 cases), Canada (45 cases),¹⁹ and the United States (120 cases).¹⁹ Also, between EW 35 and EW 40 of 2017, a total of 570 suspected cases of measles were reported in 10 parishes of the municipality of Caroni, state of Bolivar, Venezuela. Of the total, 217 cases had been confirmed: 153 by laboratory criteria and 64 by epidemiological link, 292 remained under investigation, and 61 were discarded. Of the total number of suspected cases, 77% were ≤ 10 years old and 56% were male. Deaths from measles had not been reported.

All the cases confirmed in the Region of the Americas were imported from other continents, were related to imported cases, or had an unknown infection source. Identified genotypes were D8 in Argentina, B3 and D8 in Canada and the United States, and D8 in Venezuela (with a different lineage from the D8 identified in Brazil in previous years).

1 December 2017²¹

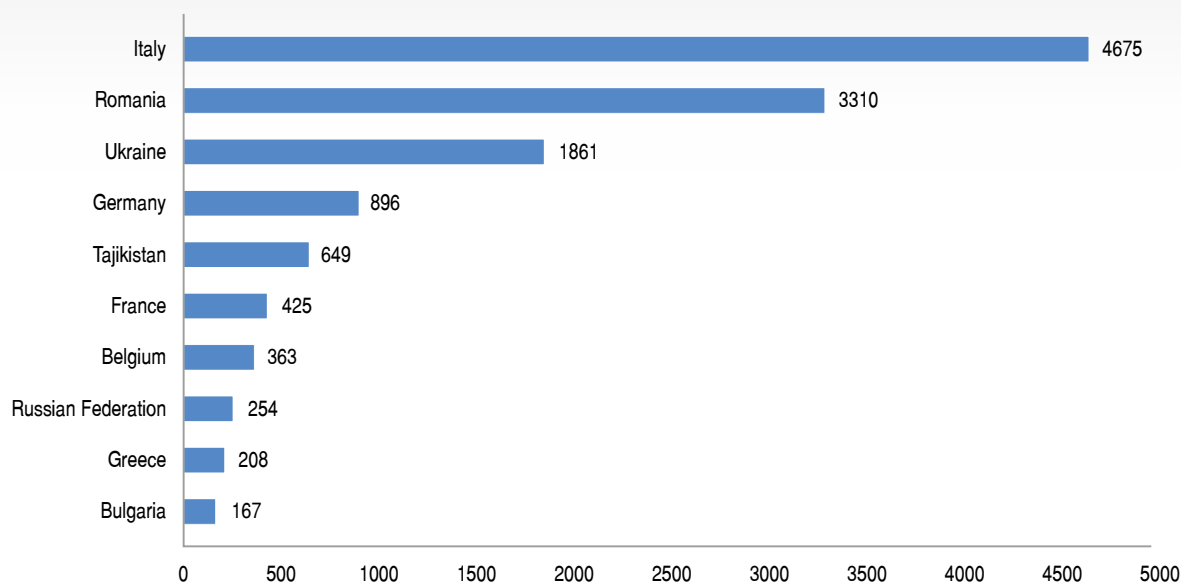
Situation in Europe

In the period between October 2016 and September 2017, countries in the WHO European Region reported 15,941 confirmed cases of measles; of those, 86% (13,712) were reported in 2017. The highest incidence was recorded in Romania (252.4 cases per 1 million population), Italy (82.4 cases per 1 million population), and Tajikistan (77.3 cases per 1 million population) (Figure 9). In 2017, there were 20 deaths from measles, 10 of them in Romania.

In 2017, 56% (7,725) of measles cases in the WHO European Region were laboratory-confirmed (serology, viral detection or isolation) and the rest by epidemiological link or clinically compatible.

²¹ Pan American Health Organization / World Health Organization. Measles Epidemiological Update, 1 December 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2Huz8Hb>

Figure 9. Number of cases of measles in 10 countries with the greatest number of cases reported, WHO European Region, 1 January to 30 September 2017



Source: WHO Regional Office for the European Region, Vaccine-preventable Diseases and Immunization Programme.

Countries reporting cases of measles in other regions in 2016-2017, remained the same as previously reported.

Region of the Americas

Between EW 1 and EW 46 of 2017, 600 cases of laboratory-confirmed measles in four countries of the Region of the Americas were reported: Argentina (3 cases), Canada (46 cases)¹⁹, United States (120 cases)¹⁹, and Venezuela (431). Of the cases reported in Argentina, Canada, and the United States, 36% were children between the ages of 1 and 4 years, and 60% of the total did not have a history of vaccination against measles and rubella.

Venezuela. Between EW 36 and EW 47 of 2017, 773 suspected cases of measles were detected, of which 431 had laboratory confirmation or had been confirmed by epidemiological link; 188 were discarded, and 154 remained under investigation. No deaths were reported. Most cases came from the state of Bolivar. In the state of Anzoategui, two confirmed cases, both with epidemiological link with the state of Bolivar, were detected. Epidemiological surveillance did not find suspected cases related to this outbreak in other federal entities.

Confirmed cases in the outbreak in the state of Bolivar were mostly infants < 1 years of age (incidence rate = 415 cases per 100,000 population), and 1-year-old children (incidence rate = 248 cases per 100,000 population). Case-finding activities continued, as well as vaccination at the institutional level, in educational centers, door-to-door, and in designated locations, with indiscriminate vaccination with the triple viral vaccine (MMR) of the population 6 months to 5 years of age. The measles and rubella vaccine or MR was also administered to children 6 to 10 years of age, and selective vaccination with MR vaccine of contacts was conducted for 11 to 39-year-olds.

A summary of the PAHO/WHO collaboration activities with the Venezuela Ministry of Popular Power for Health with regard to the response plan for the interruption of measles outbreaks and control of diphtheria in Venezuela, is available at: <https://sway.com/QMZ5v7quo1AianxU?ref=Link>.

Recommendations

1. Travelers

Prior to departure

PAHO/WHO recommends that all travelers over the age of six months who are unable to show proof of vaccination or immunity, be fully vaccinated against measles and rubella, preferably with the MMR (measles, mumps, and rubella) vaccine, at least two weeks before traveling to areas with documented measles virus circulation.

- Infants who receive the MMR vaccine before their first birthday must be revaccinated according to their country's vaccination schedule. Infants under the age of six months should not be vaccinated.
- Travelers who are not up to date on their vaccinations are at higher risk of contracting either disease when in close contact with travelers from countries where the viruses still circulate.
- Exceptions to this recommendation include persons with medical contraindications to the measles and rubella vaccine.
- Persons considered immune to measles and rubella, are those who can present:
 - Laboratory confirmation of rubella and measles immunity (a positive serological test for the measles and rubella-specific IgG antibodies).
 - Written documentation of measles and rubella vaccination.

It is recommended that health authorities inform travelers, prior to departure, of measles signs and symptoms, including:

- Fever
- Rash
- Cough, coryza (runny nose), or conjunctivitis (red eyes)
- Joint pain
- Lymphadenopathy (swollen glands)

During the trip

1. Travelers should be advised that, if they suspect they might have measles or rubella, they should:
 - Seek professional health care immediately.
 - Avoid close contact with other people for seven days following the onset of rash.
 - Remain at the site of their current residence (e.g., hotel or home, etc.) except to seek professional health care, or as advised by a health professional.
 - Avoid travel and public places.

Upon returning

1. If travelers suspect they have measles or rubella, they should seek immediate professional health care.

2. If travelers develop any of the above-mentioned symptoms, they should inform their physician of their travel history.

2. Clinicians and health care providers

PAHO/WHO recommends to:

1. Promote the practice of requesting proof of immunity to measles and rubella in the health care sector (medical, administrative, and security personnel).
2. Since international travelers may seek medical attention at private health care facilities, sensitize private sector health workers on the need for immediate notification of any measles or rubella cases to ensure a timely response by national public health authorities.
3. Continue to remind health care workers to always ask patients for their travel history.

3. Persons and institutions in contact with travelers, before and/or after their trip

1. Advise personnel in the tourism and transportation sectors (i.e., hotels, airport, taxis, and other) to be fully immunized against measles and rubella, and make the necessary regulatory and operational arrangements to promote vaccination.
2. Conduct public awareness campaigns on the symptoms of measles and rubella, so that all travelers can recognize the symptoms and seek immediate medical care if need be. Information should be distributed at airports, ports, bus stations, travel agencies, airlines, etc.

4. Contact tracing of confirmed cases of measles

1. Conduct contact tracing activities according to national guidelines for contacts identified and present in the national territory;
2. Consider the international implications that may arise from contact tracing, as well as the following scenarios and operational aspects while conducting these activities:
 - A case is identified by national authorities in a third party and national authorities are requested to locate contacts whose residence is most likely within their country. National authorities are urged to use all available coordination mechanisms to locate these persons. The information available for this action could be limited and efforts should be rational and based on existing resources. Health services should be alerted of the potential or actual presence of contacts in order to detect suspected cases.
 - A case is identified locally, and, depending on the timing of the natural history of the diseases at detection:
 - Current case: national authorities should obtain information about the possible location of contacts abroad and inform the relevant national authorities accordingly.
 - Retrospectively identified case: According to the travel history of the case, national authorities should inform relevant counterparts, as this occurrence might constitute the first signal of measles virus circulation, or of an outbreak, in the other country or countries concerned.
3. Conduct active institutional and community searches to quickly identify cases among those contacts that have not been identified during the outbreak investigation, following the route of the case(s).

Operational remarks

- If no international conveyances are involved (e.g., aircrafts, cruise ships, trains) as a possible setting for exposure to a case(s), national authorities should contact their counterpart(s) of other countries through the IHR NFP network or other bilateral or multilateral programmatic mechanisms, with copy to the WHO IHR Contact Point for the Americas. The assistance of the WHO IHR Contact Point for the Americas can be requested to facilitate international contact tracing related communications.
- If international conveyances are involved (e.g., aircrafts, cruise ships, trains) as a possible setting for exposure to a case(s), national port authorities or whoever may be acting for the latter should activate existing mechanisms to obtain relevant information from carriers (e.g., airlines) to locate travelers, or establish such mechanisms if absent. For subsequent communication between national authorities see preceding paragraphs.

Channels for the dissemination of these recommendations

PAHO/WHO recommends that national authorities consider disseminating the recommendations outlined in this document through:

- Public awareness campaigns to promote and enhance travelers' health before and after their trip, so that they may adopt healthy behaviors related to measles vaccination, and to recognize the signs and symptoms of measles. For this purpose, advantage should be taken of travel medicine services or clinics, airports, ports, bus and train stations, and airlines operating in the country.
- Travel agencies and other tourism related agencies, and the diplomatic corps, so that travelers may take necessary actions prior to travel.
- Reiteration of the content of existing national guidelines to clinicians and health care providers, and timely dissemination of any newly developed procedure in relation to travelers, as applicable.

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Related Links

- PAHO/WHO. Immunization. Available at: <https://bit.ly/2HMUbRd>



Yellow fever

Between January 2016 and December 2017, seven countries and territories of the Region of the Americas reported confirmed cases of yellow fever: Bolivia, Brazil, Colombia, Ecuador, French Guiana, Peru, and Suriname. During that period, the greatest number of human cases and epizootics were reported in the Americas in decades. These were related to the ecosystem, favorable to the spread of the virus, and to the presence of unimmunized populations.

A decade ago an outbreak of yellow fever and epizootic waves affected the southeast and south of Brazil, subsequently reaching Argentina and Paraguay; consequently, it became necessary to monitor yellow fever patterns in that area of Brazil during the 2017-2018 outbreak. Although other countries or territories had not reported cases of yellow fever linked to the Brazilian outbreaks, the latter events posed a risk of circulation of the virus in bordering countries, especially, in areas of shared ecosystems.

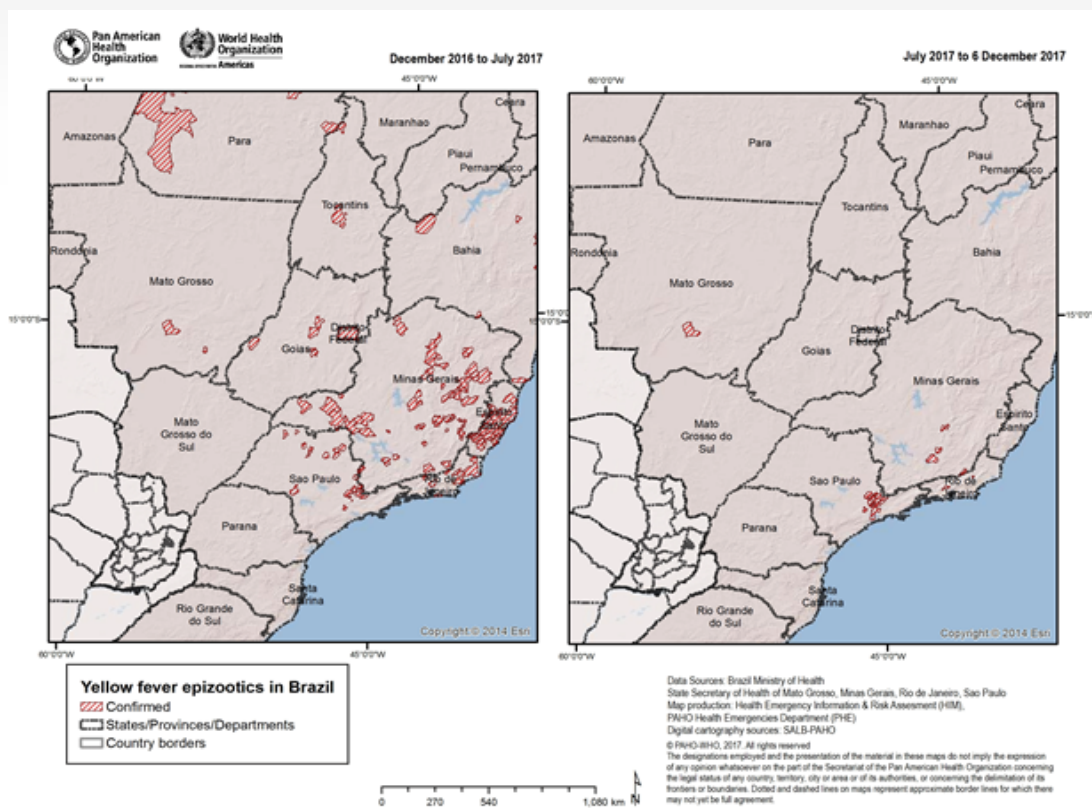
By the date of this report, there was no proof that the *Aedes aegypti* mosquito was part of the transmission chain in the current outbreaks. Nonetheless, potential risks in changes in the cycle of transmission could not be ruled out.

The largest yellow fever outbreak occurred in Brazil between the second semester of 2016 and June 2017, with 779 confirmed cases, 262 deaths, and 1,659 epizootics.

The highest number of confirmed epizootics was recorded in Sao Paulo (120), but epizootic events were also confirmed in the state of Mato Grosso, Cuiaba municipality (1), the state of Minas Gerais (21), and the state of Rio de Janeiro (2). Epizootics confirmed in the states of Minas Gerais and Sao Paulo occurred in the same areas affected by the 2016-2017 outbreak and point to a persistent risk of human cases. Figure 10 shows the distribution of yellow fever epizootics in nonhuman primates, by municipality, confirmed between December 2016 and June 2017, and between July 2017 and on 6 December 2017.

Given the above situation, PAHO/WHO began weekly reporting of epidemiological changes via Epidemiological Alerts and Updates. The Epidemiological Alerts and Updates relating to yellow fever published in 2017, by EW and by country, are summarized below. Recommendations to address the occurrence of cases and outbreaks of the disease, including public health measures and related laboratory procedures, were published on a timely basis, and are described at the end of this section. The references and useful links published are also listed.

Figure 10. Epizootics of yellow fever, Brazil, December 2016 through July 2017, and July 2017 through 6 December 2017



9 January 2017²²

Brazil. In 2015, 9 cases of jungle yellow fever were confirmed in three states: Goiás (6 cases), Pará (2 cases), and Mato Grosso do Sul (1 case); the CFR was 55.5%. In 2016, six cases of yellow fever were confirmed, and there was one imported case from Angola. The six autochthonous confirmed cases had probable sites of infection as the following states: Goiás (3 cases), São Paulo (2 cases), and Amazonas (1 case). The number of epizootics, especially in the state of São Paulo, increased considerably with respect to previous years. Indeed, from the beginning of 2016 through 12 December of that same year, 163 epizootics had been reported in nonhuman primates in the state of São Paulo, with a total of 227 affected animals. Up to 9 January 2017, a total of 16 epizootics, affecting 24 nonhuman primates, had been confirmed, while 35 were discarded.

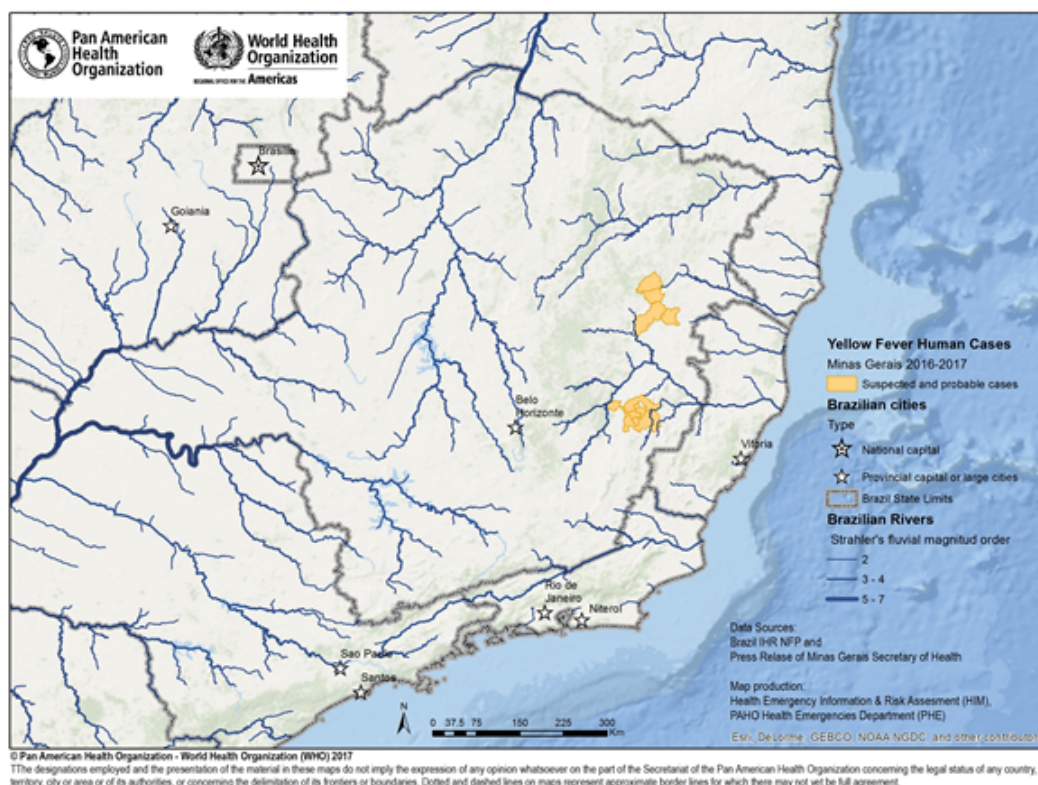
Between January and 12 December of 2016, the following municipalities reported confirmed epizootics of yellow fever in the state of São Paulo: Ribeirão Preto (Jaboticabal, Monte Alto, and Ribeirão Preto); Barretos (Cajobi and Severineia), and São José do Rio Preto (Pindorama, Potirendaba, Catanduva, Ibira, Adolfo, Catigua, and São José do Rio Preto). In addition, on 4 January 2017, the Ministry of Health of Fernandópolis, also in the state of São Paulo, confirmed the death of a nonhuman primate from yellow fever infection. That primate was found on 8 December of 2016, in an area located between São Vincent de Paulo and Recanto do Tamburi.

On 6 January 2017, the Brazil IHR NFP reported 23 suspected and probable cases of yellow fever (Figure 11), including 14 deaths, in 10 municipalities of Minas Gerais. The date of

²² PAHO/WHO. Epidemiological Update: Yellow Fever. 9 January 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HTmg1t>

onset of symptoms in the first case was 18 December 2016. Of the 12 cases with available information, all were male, and came from rural areas; the median age was 36.6 years (range 7 and 53 years).

Figure 11. Suspected and probable cases of yellow fever reported in Minas Gerais, Brazil, by geographical location, 2016 - 2017



Colombia. Between EW 1 and EW 52 of 2016, 12 cases of jungle yellow fever were reported (7 laboratory-confirmed and 5 probable cases). All confirmed cases were male; 57% were between 20 and 29 years of age, and 6 of the 7 confirmed cases died. The department of origin of those cases are listed in Table 2.

As was reported in the Epidemiological Update of 14 December 2016²³, the confirmation of cases in Vichada (border with Venezuela), Choco (border with Panama) and Guainia (border with Venezuela and Brazil) poses a risk of viral circulation into those countries, especially in areas with shared ecosystems.

²³ PAHO/WHO. Epidemiological Update: Yellow Fever. 14 December 2016, Washington, D.C.: PAHO/WHO; 2016. Available at: <https://bit.ly/2HL8r0X>

Table 2. Probable and confirmed yellow fever cases, by territorial entity, Colombia, EW 1 to EW 52 of 2016

Reporting territorial entity	Territorial entity of origin	Probable case	Confirmed case	Total
Meta	Meta	0	2	2
Córdoba	Córdoba	1	0	1
Vichada	Vichada	2	1	3
Vaupés	Vaupés	1	1	2
Antioquia	Chocó	0	1	1
Amazonas	Imported *	0	1	1
Santa Marta	Santa Marta	1	0	1
Guainía	Guainía	0	1	1
Total		5	7	12

* Cabalococha Municipality, Peru.

Source: Colombia National Institute of Health Epidemiological Bulletin, EW 52 of 2016

18 January 2017²⁴

Brazil. A yellow fever outbreak was reported in the state of Minas Gerais, as well as epizootics in the neighboring state of Espírito Santo. From EW 1 of 2017 through 18 January 2017, a total of 206 suspected and probable cases of yellow fever had been reported in Minas Gerais, including 53 deaths. Of the 53 probable cases, 22 died. Human cases were reported in 29 municipalities, 22 of which also reported epizootics in nonhuman primates. Of 37 probable cases with information available, 35 (94.5%) were male; the average age was 46 years.

In the neighboring state of Espírito Santo, which is not considered a risk area for yellow fever, four suspected cases of the disease were reported. Epizootics were also reported among nonhuman primates in 14 municipalities of that state.

Peru. Up to EW 52 of 2016, 79 confirmed and probable cases of jungle yellow fever had been reported, including 24 deaths. Of the total number of cases, 62 were confirmed, and 17 classified as probable. Throughout 2016, the department of Junín reported 51 cases, the highest number for any department, followed by Ayacucho (7 cases), and San Martín (5 cases). The total number of confirmed and probable cases reported for this period is the highest of the nine previous years.

26 January 2017²⁵

Brazil. As 26 January 2017, 7 cases of yellow fever had been confirmed for 2016 in the states of: Goiás (3 cases), São Paulo (2 cases), and Amazonas (2 cases). The CFR was 71%. For 2017, a total of 550 cases of yellow fever had been reported in humans (72 confirmed, 23 discarded, and 455 suspected cases under investigation), including 105 deaths (40 confirmed and 65 under investigation). The CFR was 55% among confirmed cases, and 14% among suspected cases. There were six states where cases probably contracted the infection: Bahia,

²⁴ PAHO/WHO. Epidemiological Update: Yellow Fever. 18 January 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2JNZy30>

²⁵ PAHO/WHO. Epidemiological Update: Yellow Fever. 26 January 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2jXks4o>

Espirito Santo, Goias, Mato Grosso do Sul, Minas Gerais, and Sao Paulo. Of the confirmed deaths, 37 occurred in the state of Minas Gerais, and 3 in Sao Paulo. Table 3 and Figure 12 summarize confirmed yellow fever cases, and their distribution by date of onset of symptoms in Minas Gerais.

In addition to human cases, 268 epizootics were reported in nonhuman primates, with a total of 777 deaths. Of the latter, 7 deaths had a confirmed yellow fever diagnosis in the following states: Sao Paulo (3) and Espirito Santo (4).

Cumulative number of vaccine doses distributed to the states of Bahia, Espirito Santo, Minas Gerais, Sao Paulo, and Rio de Janeiro: 5.3 million.

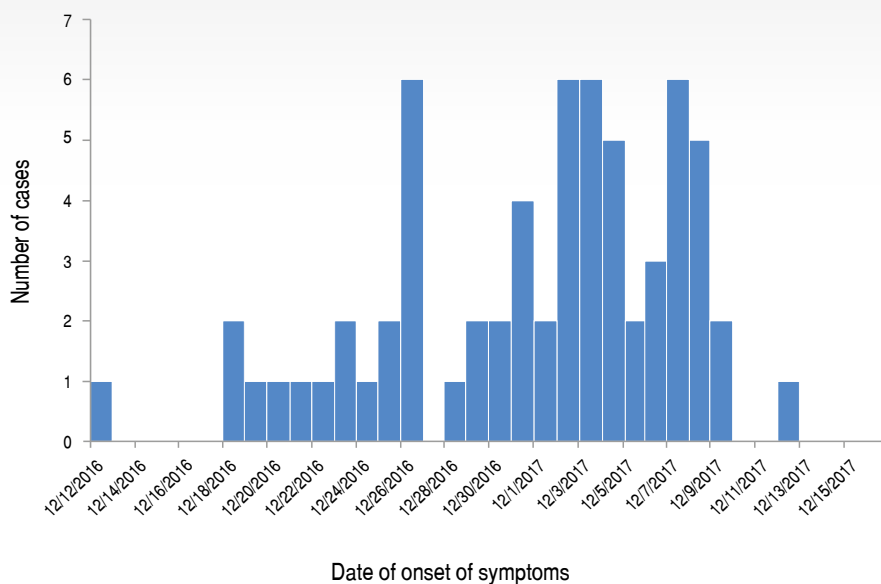
As of 26 January 2017, there was no evidence of *Aedes aegypti* mosquitoes being involved in yellow fever transmission in the current outbreaks. However, the potential risk of yellow fever reurbanization could not be discarded. Furthermore, more cases were expected due to intense internal population migration, the current distribution of epizootics, and low vaccination coverage in places previously considered of no risk for yellow fever transmission.

Table 3. Number of human cases of yellow fever, by probable place of infection, Brazil, 1 December 2016 through 26 January 2017

State	Number of municipalities reporting cases	Number of cases			
		Reported	Suspected (deaths)	Confirmed (deaths)	Discarded
Central-West Region					
Goias	1	1	1 (1)	0	0
Mato Grosso do Sul	1	1	1 (0)	0	0
North East Region					
Bahia	3	7	6(0)	0	1
Southeastern Region					
Espirito Santo	18	33	32 (3)	1	0
Minas Gerais	51	502	415 (61)	68 (37)	19
Sao Paulo	3	3	0 (0)	3 (3)	0
Total	77	547*	455 (65)	72 (40)	20*

* Includes three cases reported in the Federal District, which were subsequently discarded.
Source: Secretary of Health Surveillance. Brazil Ministry of Health

Figure 12. Confirmed cases of yellow fever, by date of onset of symptoms, Minas Gerais, Brazil, 12 December 2016 to 15 January 2017



Source: Ministry of Health of the state of Minas Gerais

At this time, it was determined that yellow fever outbreaks in Brazil went beyond the areas that had been considered at risk of transmission since 2013,²⁶ and a reevaluation of at risk areas was conducted, to inform national immunization programs, and to update recommendations for travelers.

The WHO Secretariat updated the information on yellow fever transmission risk areas in Brazil²⁷, based on data provided by the Brazilian Ministry of Health to PAHO/WHO, and considering that health authorities of Bahia and Espírito Santo had redefined those states' risk areas (Figure 13).

The new areas classified at risk for yellow fever transmission correspond to a preliminary stage of a dynamic process of risk assessment, which will continue to be analyzed, by the WHO Secretariat, the Ministry of Health of Brazil, and the Scientific and Technical Advisory Group on Geographical Yellow Fever Risk Mapping (GRYF)^{28,29}, as the epidemiological situation evolves. Risk assessment results are published in PAHO/WHO and WHO web pages.

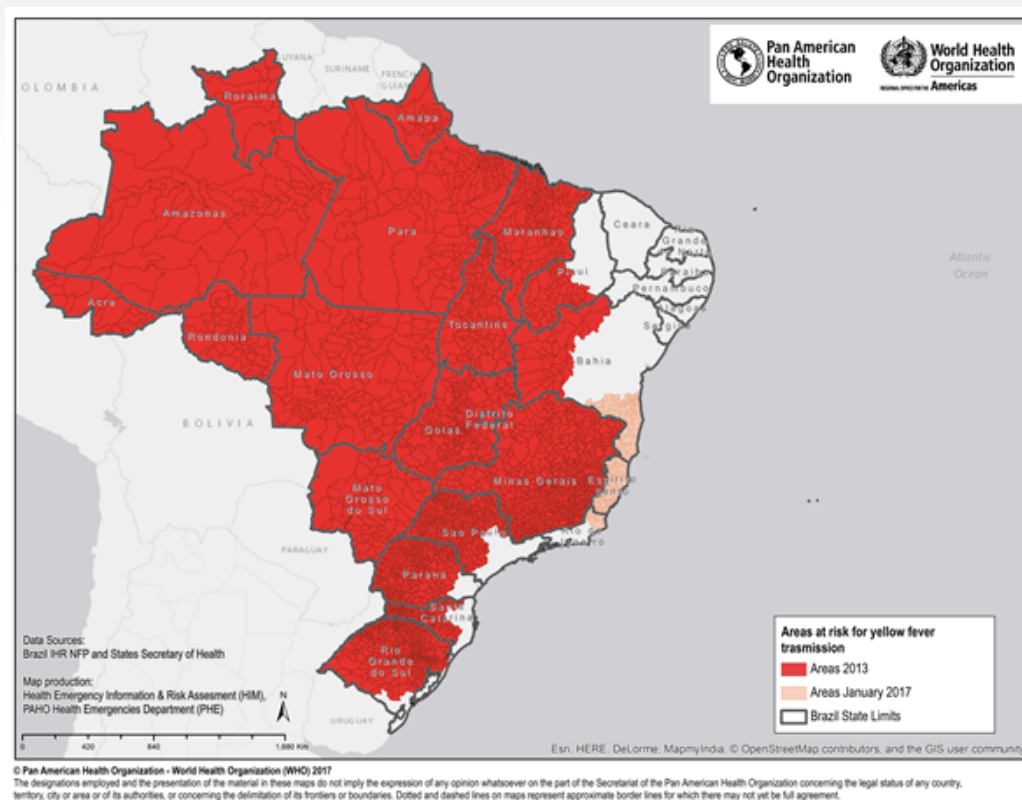
²⁶ See the World Health Organization publication: "International Travel and Health, 2016."

²⁷ The revision took into account the following factors: evidence of transmission cycles currently sustaining the outbreaks and upsurge of human cases of yellow fever; distribution of newly occurring yellow fever epizootics; distribution of newly occurring human cases of yellow fever; shared ecosystem in terms of typology of forests, non-human primates population, hydrogeological basins; domestic travel and trade routes; risk assessments by health authorities of Bahia and Espírito Santo States; and administrative borders of the municipalities.

²⁸ The criteria for risk classification are available at: http://www.who.int/ith/yellow-fever-risk-mapping/risk_mapping/en/ and http://www.who.int/ith/yellow-fever-risk-mapping/risk_mapping_table1.jpg.

²⁹ Established in accordance to Resolution WHA68.4.

Figure 13. Areas at risk for yellow fever transmission, Brazil, 2013-2017



Colombia. During the EW 2 of 2017, a probable case of yellow fever was reported in a 20-year-old male. The case had probably contracted the infection in the department of Meta, where two cases had been reported in 2016.

Peru. Up to EW 2 of 2017, a probable case had been reported in the department of Cusco, where cases had also been reported in 2016.

2 February 2017³⁰

As of 2 February 2017, only Brazil had reported confirmed cases of yellow fever, while Colombia and Peru had reported probable cases.

Brazil. Between 1 December 2016 and 2 February 2017, 901 cases of yellow fever were reported; 151 of them were confirmed, 42 were discarded, and 708 classified as suspected, which were still under investigation. Also, 143 yellow fever deaths had been reported: 54 confirmed, 3 discarded, and 86 that remained under investigation. The CFR among all reported cases was 16%, but it was 36% for confirmed cases, and 12% for suspected cases.

The states where suspected and confirmed cases probably contracted the infection were: Bahia, Espírito Santo, Minas Gerais, Sao Paulo, and Tocantins. The CFR of suspected and confirmed cases combined, by state, was: 12% in Espírito Santo, 16% in Minas Gerais, and 43% in Sao Paulo. Of all confirmed cases and deaths, Minas Gerais reported 134 cases and 48 deaths, Sao Paulo, 4 cases and 3 deaths, and Espírito Santo, 13 cases and 3 deaths. Of the confirmed cases, 50% were males between the ages of 31 and 50 years.

³⁰ PAHO/WHO. Epidemiological Update: Yellow Fever. 2 February 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2Kwit3R>

A total of 412 epizootics were also reported in nonhuman primates, with 1,202 deaths, of which 259 had been confirmed as yellow fever. The epizootics were reported in Roraima (border with Venezuela), Tocantins, Goias, Minas Gerais, Bahia, Espirito Santo, Sao Paulo, Mato Grosso do Sul (border with Argentina), Rio Grande do Norte, Parana (border with Argentina and Paraguay), and the Federal District. The occurrence of epizootics in Roraima, Mato Grosso do Sul and Parana posed a risk of viral circulation toward bordering countries, especially in areas sharing ecosystems.

Cumulative number of doses of vaccines distributed to the states of Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo: 7.8 million.

9 February 2017³¹

Up to 8 February 2017, only Brazil had reported confirmed cases of yellow fever; Colombia and Peru had reported one and three probable cases, respectively.

Brazil. Between 1 December 2016 and 8 February 2017, 1,060 cases of yellow fever had been reported. Of those, 215 were confirmed, 80 had been discarded, and 765 were suspicious. The number of deaths reached 166; 70 confirmed, 3 discarded, and 93 under investigation. The CFR among confirmed cases was 33%, and among suspected cases, 12%. According to the probable site of infection suspected and confirmed cases were distributed in five states:³² Bahia, Espirito Santo, Minas Gerais, Sao Paulo, and Tocantins. The confirmed cases were distributed in three states: Espirito Santo (20), Minas Gerais (191), and Sao Paulo (4). Among confirmed cases, 69% were male between the ages of 21 and 60 years. Of confirmed deaths, 61 occurred in the state of Minas Gerais (7% CFR), 3 in Sao Paulo (33% CFR), and 6 in Espirito Santo (6% CFR).

States with epizootics reported in nonhuman primates (bordering countries in parentheses): Alagoas, Bahia, Goias, Espirito Santo, Mato Grosso do Sul (Bolivia and Paraguay), Minas Gerais, Para (Suriname and Guyana), Parana (Argentina and Paraguay), Pernambuco, Rio Grande do Norte, Rio Grande do Sul (Argentina and Uruguay), Roraima (Venezuela), Santa Catarina (Argentina), Sao Paulo, Sergipe, Tocantins, and the Federal District. There were 1,408 deaths among these primates, 298 of them with confirmed yellow fever diagnosis.

Cumulative number of doses of vaccines distributed to the states of Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo: 9.9 million.

16 February 2017³³

From the beginning of 2017 to EW 5 of 2017, Bolivia, Brazil, Colombia, and Peru had reported cases of yellow fever. Colombia and Peru had reported one and three probable cases, respectively, and Bolivia, one case that was under investigation. Brazil had reported confirmed and suspected cases.

Bolivia. Yellow fever is endemic in Bolivia, and appeared cyclically, with outbreaks of varying magnitude, until 2012. Starting in 2013, only sporadic cases had been reported. In 2017, a case was reported in a 28-year-old unvaccinated male tourist who arrived in the country on 8 January 2017, and on 9 January travelled to the Caranavi municipality, where he probably contracted the infection. On 28 January he was seen in a local hospital, and, subsequently, transferred to a private health care center in Chile, where he was discharged on 13 February.

³¹ PAHO/WHO. Epidemiological Update: Yellow Fever. 9 February 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2JnPas>

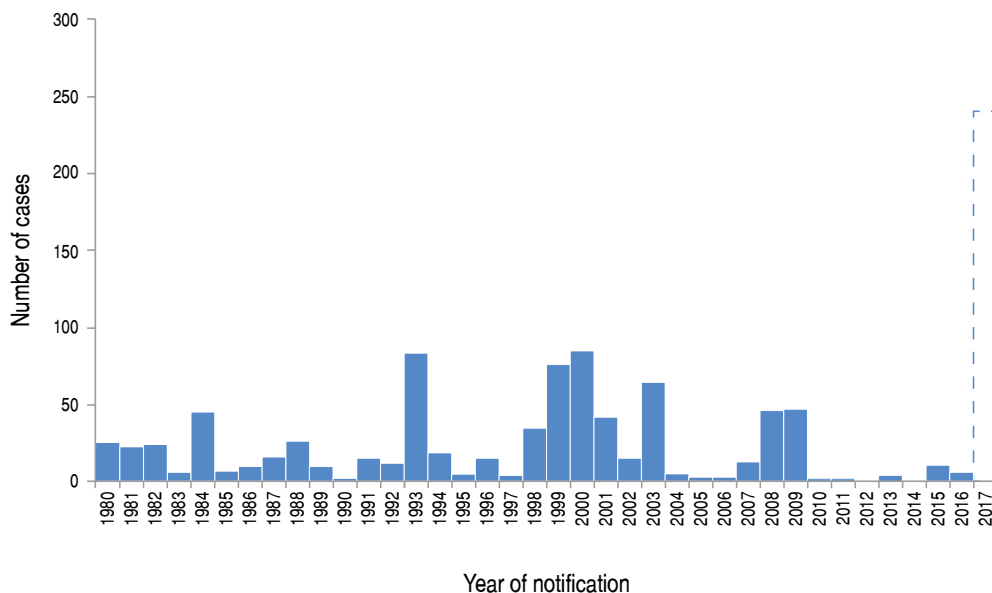
³² Additionally, there were 5 suspected cases for which the probable site of infection was under investigation.

³³ PAHO/WHO. Epidemiological Update: Yellow Fever. 16 February 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HPmkXS>

In the period when he probably contracted the infection, the case did not leave Bolivia. ELISA IgM tests conducted in Bolivia and Chile yielded positive results for yellow fever.

Brazil. Yellow fever is endemic in Brazil and occur with cyclic outbreaks of varying magnitudes. Figure 14 shows that the number of confirmed cases during the current outbreak exceeded the number of cases reported in preceding decades.

Figure 14. Confirmed cases of yellow fever, by year, Brazil, 1980 to EW 5 of 2017



Sources: Data published by the Brazil Ministry of Health. 1980 to 2016 data from *Historical series of confirmed cases of yellow fever in Brazil, 1980 - 2016, figure 1* and 2017 data from Report N ° 17 of Monitoring cases and deaths of Yellow Fever in Brazil. Available at: <http://portalsaude.saude.gov.br/index.php/situacao-epidemiologica-dados-febreamarela> and reproduced by PAHO/WHO.

Between 1 December 2016 and 15 February 2017, 1,236 cases of yellow fever were reported (243 confirmed, 108 discarded, and 885 suspected), including 197 deaths (82 confirmed, 3 discarded, and 112 under investigation). The CFR was 34% among confirmed cases, and 13% among suspected cases.

Suspected and confirmed cases, by probable place of infection:³⁴ Bahia, Espírito Santo, Minas Gerais, Rio Grande do Norte, Sao Paulo, and Tocantins.

Confirmed cases, by probable place of infection: Espírito Santo, Minas Gerais, and Sao Paulo.

Confirmed deaths, by probable place of infection: 70 in Minas Gerais (34% CFR), 3 in Sao Paulo (75% CFR), and 9 in Espírito Santo (29% CFR).

Of the confirmed cases, 209 (86%) were male, of these, 80% were between 21 and 60 years old. To this date, the number of cases by EW of onset of symptoms seemed to be on a downward trend.

³⁴ In addition, there were five suspected cases whose probable place of infection was under investigation.

States affected by the 647 epizootics reported in nonhuman primates were (in parentheses, bordering countries): Alagoas, Bahia, Goias, Espirito Santo, Mato Grosso do Sul (Bolivia and Paraguay), Minas Gerais, Para (Suriname and Guyana), Parana (Argentina and Paraguay), Pernambuco, Rio Grande do Norte, Rio Grande do Sul (Argentina and Uruguay), Roraima (Venezuela), Santa Catarina (Argentina), Sao Paulo, Sergipe, Tocantins, and the Federal District. There were 1,408 deaths among these primates, of which 298 had confirmed yellow fever diagnoses.

No cases of yellow fever in other countries or territories had been linked to the outbreaks in Brazil. However, those events posed a risk of virus circulation in bordering countries, especially in places that share ecosystems.

Cumulative number of vaccine doses distributed to the states of Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo: 12.5 million.

23 February 2017³⁵

From EW 1 of 2017 through 23 February 2017, Bolivia, Brazil, Colombia, and Peru had reported suspected and confirmed cases of yellow fever.

Brazil. From the onset of the outbreak in December 2016 until EW 6 of 2017, 1,336 cases of yellow fever had been reported: 292 confirmed, 124 discarded, and 920 suspected. Also reported were 215 deaths (101 confirmed, 5 discarded, and 109 under investigation). The CFR for confirmed cases was 35%, and 12% for suspected cases.

Suspected and confirmed cases, by probable place of infection of:³⁴ Bahia, Espirito Santo, Minas Gerais, Rio Grande do Norte, Sao Paulo, and Tocantins.

Confirmed cases, by probable place of infection: Espirito Santo (42 cases), Minas Gerais (246 cases), and Sao Paulo (4 cases).

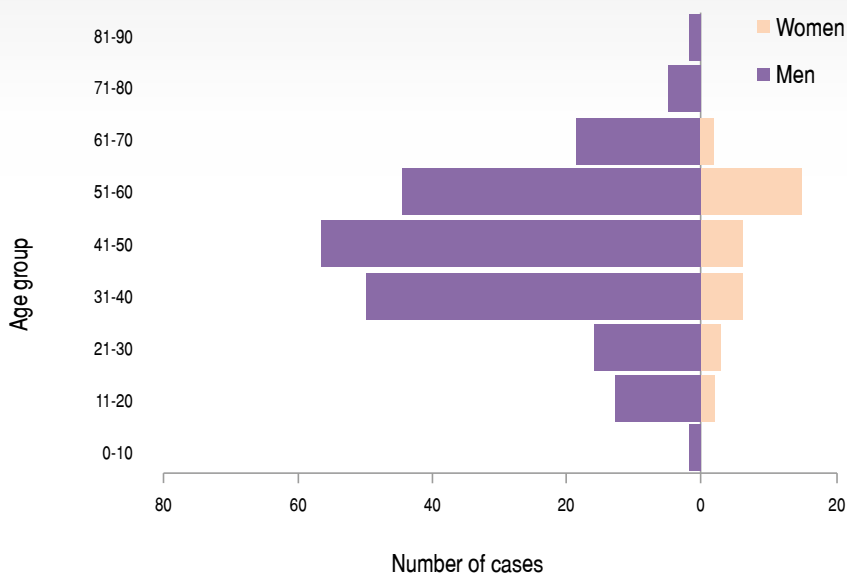
Confirmed deaths, by probable place of infection: 84 in Minas Gerais (34% CFR), 3 in Sao Paulo (75% CFR), and 14 in Espirito Santo (33% CFR).

Starting in EW 3 of 2017, the number of cases in Minas Gerais, where 84% of suspected and confirmed cases had been reported, seemed to be decreasing in its four administrative regions. During that same week, the peak of the epidemiological curve was reached, with approximately 360 reported cases.

Among confirmed cases, 86% (252) were male, and of those 81% were between 21 and 60 years of age (Figure 15).

³⁵ PAHO/WHO. Epidemiological Update: Yellow Fever. 23 February 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HI0mls>

Figure 15. Confirmed cases of yellow fever, by age group and sex, Brazil, EW 48 of 2016 through EW 6 of 2017 (N=292)



Source: Ministry of Health of Brazil.

Between the 16 February PAHO/WHO Epidemiological Update on yellow fever and the date of this report, 236 new epizootics were reported in nonhuman primates, still unconfirmed. From the onset of the outbreak, 883 epizootics had been reported in nonhuman primates; of those, 377 had been confirmed as yellow fever and 8 were discarded. Those epizootics were reported in the Federal District, and in the states of Alagoas, Bahia, Goias, Espirito Santo, Mato Grosso do Sul, Minas Gerais, Parana, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, Sao Paulo, Sergipe, and Tocantins.

2 March 2017³⁶

Between EW 1 and EW 7 of 2017, Bolivia, Brazil, Colombia, and Peru had reported suspected and confirmed cases of yellow fever.

Brazil. From the onset of the outbreak in December 2016, through EW 7 of 2017, 1,367 cases of yellow fever had been reported; of those, 326 were confirmed, 125 were discarded, and 916 were suspected cases. Also reported were 220 deaths (109 confirmed, 6 discarded, and 105 under investigation). The CFR among confirmed cases was 33%, and among suspected cases, 11%.

Suspected and confirmed cases, by probable place of infection:³⁴ Bahia, Espirito Santo, Goias, Minas Gerais, Rio Grande do Norte, Sao Paulo, and Tocantins.

Confirmed cases, by probable place of infection: Espirito Santo (53), Minas Gerais (269), and Sao Paulo (4).

Confirmed deaths, by probable place of infection: 92 in Minas Gerais (34% CFR), 3 in Sao Paulo (75% CFR), and 14 Espirito Santo (26% CFR).

³⁶ PAHO/WHO. Epidemiological Update: Yellow Fever. 2 March 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2w5b08L>

Between 2 and 24 February, 120 new cases were reported in Espírito Santo, and 256 in Minas Gerais (confirmed or under investigation).

Since the last Epidemiological Update, published on 23 February 2017, 76 new epizootics were reported in nonhuman primates, and were being investigated. From the beginning of the outbreak, 959 epizootics in nonhuman primates had been reported, of which 386 had been of confirmed as yellow fever, and 8 were discarded. These epizootics had been reported in the Federal District, and in the states of Alagoas, Bahia, Goiás, Espírito Santo, Mato Grosso do Sul, Minas Gerais, Paraná, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, São Paulo, Sergipe, and Tocantins.

9 March 2017³⁷

Through EW 8 of 2017, suspected and confirmed cases of yellow fever had been reported in Bolivia, Brazil, Colombia, and Peru.

Brazil. From the onset of the outbreak in December 2016 up to EW 9 of 2017, 1,500 cases of yellow fever had been reported: 371 confirmed, 163 discarded, and 966 suspected, including 241 deaths (127 confirmed, 8 discarded, and 106 under investigation). The CFR among confirmed cases was 34% and 11% among suspected cases.

Suspected and confirmed cases, by probable place of infection:³⁴ Minas Gerais, Espírito Santo, São Paulo, Bahia, Tocantins, Rio Grande do Norte, and Goiás.

Confirmed cases, by probable place of infection: Minas Gerais (288), Espírito Santo (79), and São Paulo (4).

Confirmed deaths, by probable place of infection: 105 in Minas Gerais (36% CFR); 3 in São Paulo (75% CFR), and 19 in Espírito Santo (24% CFR).

In the state of Minas Gerais, the downward trend in the number of suspected and confirmed cases continued for the fourth consecutive week.

In EW 9 of 2017, nine new epizootics were reported in nonhuman primates, and were being investigated. From the beginning of the outbreak, 968 epizootics had been reported in nonhuman primates, 386 of them confirmed as yellow fever, and 8 were discarded. These epizootics were reported in the Federal District and in the states of Alagoas, Bahia, Goiás, Espírito Santo, Mato Grosso do Sul, Minas Gerais, Paraná, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, São Paulo, Sergipe, and Tocantins.

Although it is possible that the yellow fever transmission cycle changes during the current outbreak, to date there have not been cases transmitted by *Aedes aegypti*. Nevertheless, in Espírito Santo cases were confirmed in the municipalities of Serra and Aracruz, close to large urban areas, which, added to the epizootic confirmation and suspected case reporting in Vitória, poses a high risk of change in the cycle.

Considering dynamics of the spread of yellow fever in Espírito Santo, the occurrence of cases close to large urban areas, as well as the expansion of the vaccination campaign against yellow fever to the entire state, the Secretariat of the WHO determined that the entire state of Espírito Santo should be considered at risk of yellow fever transmission. As a result, it was recommended that international travelers to any part of that state should be vaccinated against the infection.

³⁷ PAHO/WHO. Epidemiological Update: Yellow Fever. 9 March 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2jmMxm1>

16 March 2017³⁸

Between EW 1 and EW 9 of 2017, suspected and confirmed cases of yellow fever had been reported in Bolivia, Brazil, Colombia, Ecuador, Peru, and Suriname.

Brazil. From the outbreak's onset through 13 March 2017, 1,538 cases of yellow fever had been reported: 396 confirmed, 184 discarded, and 958 suspected, with 255 deaths (134 confirmed, 9 discarded, and 112 under investigation). The CFR among confirmed cases was 34%, and in suspected cases, 12%. Between 13 February and 13 March, there were 125 new cases had been reported in Espirito Santo (confirmed and suspected) and 108 in Minas Gerais.

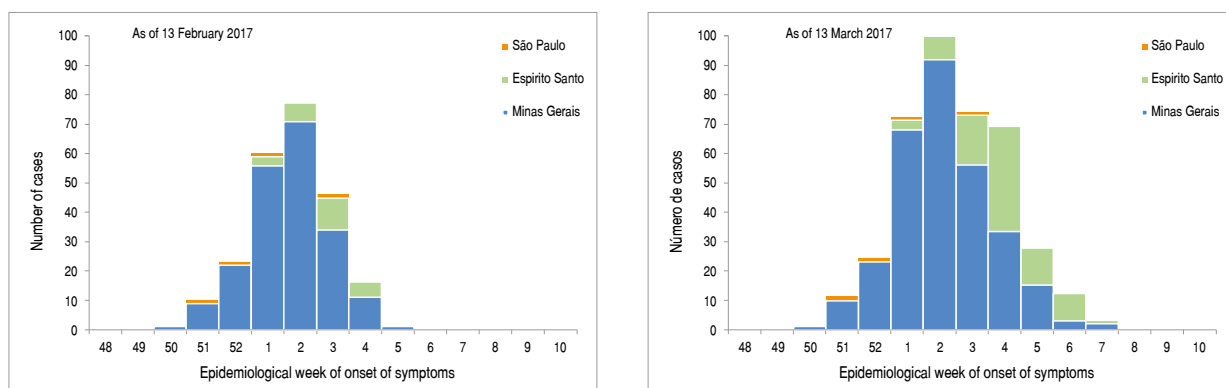
Suspected and confirmed cases, by probable place of infection: Minas Gerais, Espirito Santo, Sao Paulo, Bahia, Tocantins, Goias, and Rio Grande do Norte.

Confirmed cases, by probable place of infection: Minas Gerais (303), Espirito Santo (89), and Sao Paulo (4) (Figure 16).

Confirmed deaths, by probable place of infection: 111 in Minas Gerais (37% CFR), 20 in Espirito Santo (22% CFR), 3 in and Sao Paulo (75% CFR).

In Minas Gerais, the number of cases showed a downward trend for the fifth consecutive week, the same as in Espirito Santo as of EW 5 of 2017 (Figure 17).

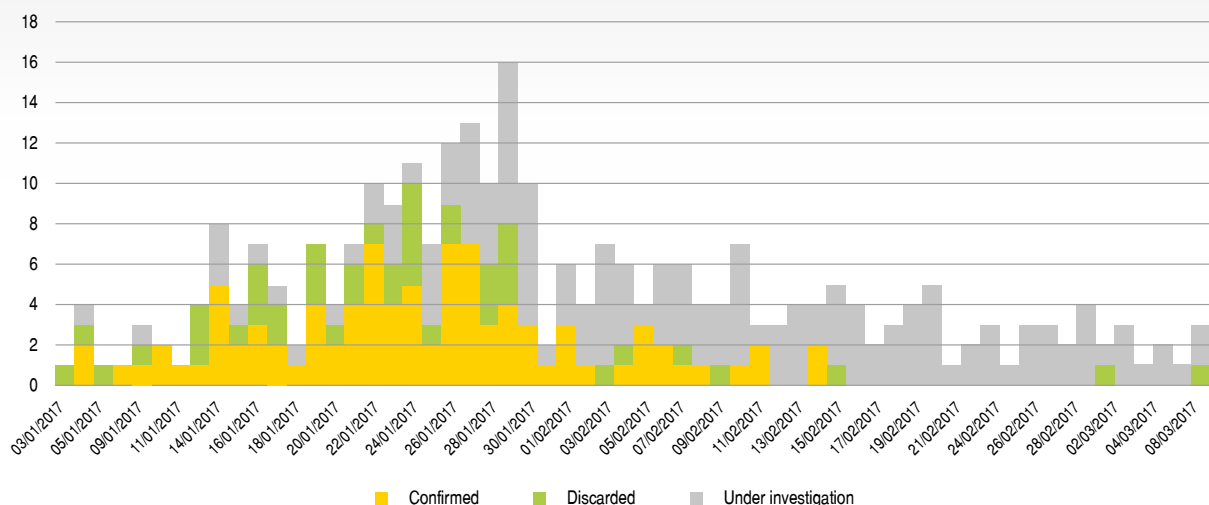
Figure 16. Confirmed cases of yellow fever, by place of occurrence and EW of onset of symptoms, Brazil, 13 February and 13 March 2017



Source: Data published by the Brazil Ministry of Health

³⁸ PAHO/WHO. Epidemiological Update: Yellow Fever. 16 March 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2JK6sGL>

Figure 17. Cases of yellow fever, by date of onset of symptoms and classification, Espirito Santo, 3 January to 8 March 2017



Source: Espirito Santo State Secretariat of Health

Between 9 and 13 March 2017, 260 new epizootics had been reported in nonhuman primates, and were under investigation, but none had been confirmed in that period. As of the outbreak's onset, a total of 1,228 epizootics in nonhuman primates had been reported, of which 386 had been confirmed as yellow fever, and 11 had been discarded. Those epizootics were reported in the Federal District, and in the states of Alagoas, Bahia, Goias, Espirito Santo, Mato Grosso do Sul, Minas Gerais, Para, Paraiba, Parana, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Rondonia, Santa Catarina, Sao Paulo, Sergipe, and Tocantins.

Ecuador. In EW 10 of 2017, the IHR NFP reported to the PAHO/WHO a confirmed case of yellow fever in a 31-year-old male from the province of Sucumbios, bordering Colombia. The case was confirmed by the National Reference Laboratory by RT-PCR. This is the first case reported in Ecuador since 2012, when a case was confirmed in Napo province.

Peru. Up to EW 9 of 2017, seven confirmed and probable cases of yellow fever had been reported, including two deaths. The department of Ayacucho had three confirmed cases of the disease in the districts of Sivia and Santa Rosa, with one death in the latter district. The four remaining cases were classified as probable, and had been detected in the departments of: Amazonas (2 cases), San Martin (1 case), and Pasco (1 case).

Suriname. This country had not reported cases of yellow fever since 1972. However, during EW 10 of 2017, the Netherlands IHR NFP reported a case of laboratory-confirmed yellow fever. The case was a Dutch traveler who had not been vaccinated against yellow fever and had been in Suriname from the middle of February to early March 2017. The case was confirmed by the Erasmus Medical Center, Rotterdam, by RT-PCR and sequencing, and by the Bernhard Nocht Institute of Hamburg, Germany, also by RT-PCR.

23 March 2017³⁹

Up to EW 11 of 2017, suspected and confirmed cases of yellow fever had been reported in Bolivia, Brazil, Colombia, Ecuador, Peru, and Suriname.

³⁹ PAHO/WHO. Epidemiological Update: Yellow Fever. 23 March 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HORdVq>

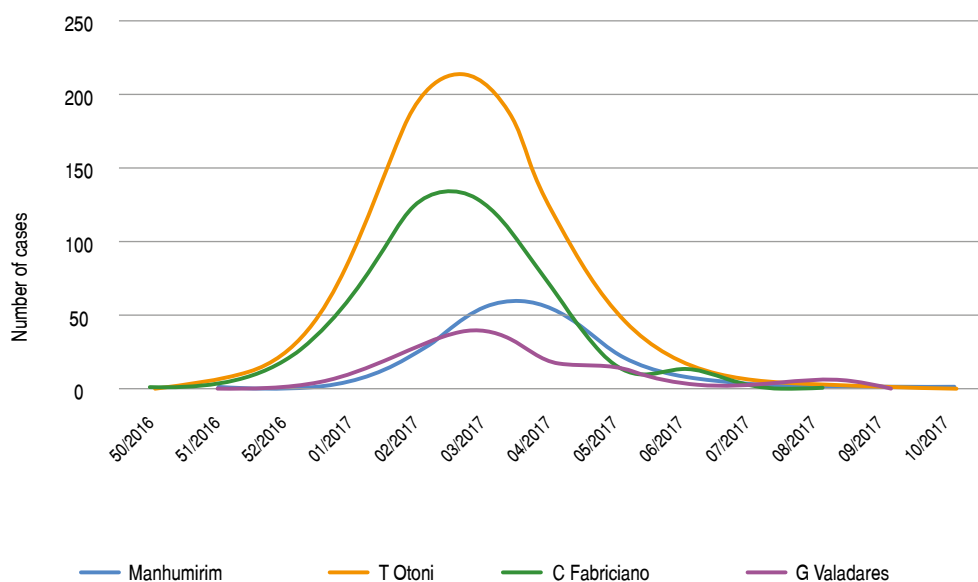
Brazil. From the beginning of the outbreak in December 2016, up to 17 March 2017, 1,561 cases of yellow fever had been reported; of those, 28.7% had been confirmed (n=448), 16.9% discarded (n = 263), and 54.4% (n = 850) were under investigation. That total included 264 deaths (144 confirmed, 10 discarded, and 110 under investigation). The case-fatality rate among confirmed cases was 32%.

Suspected and confirmed cases, by probable place of infection: Minas Gerais, Espirito Santo, Sao Paulo, Bahia, Tocantins, Goias, and Rio de Janeiro.

Out of all the municipalities affected, 188 (49.4%) were in the state of Minas Gerais. In Rio de Janeiro, the cases corresponded to three males from a rural area in the Casimiro de Abreu municipality, who did not have history of travel to states with verified viral circulation.

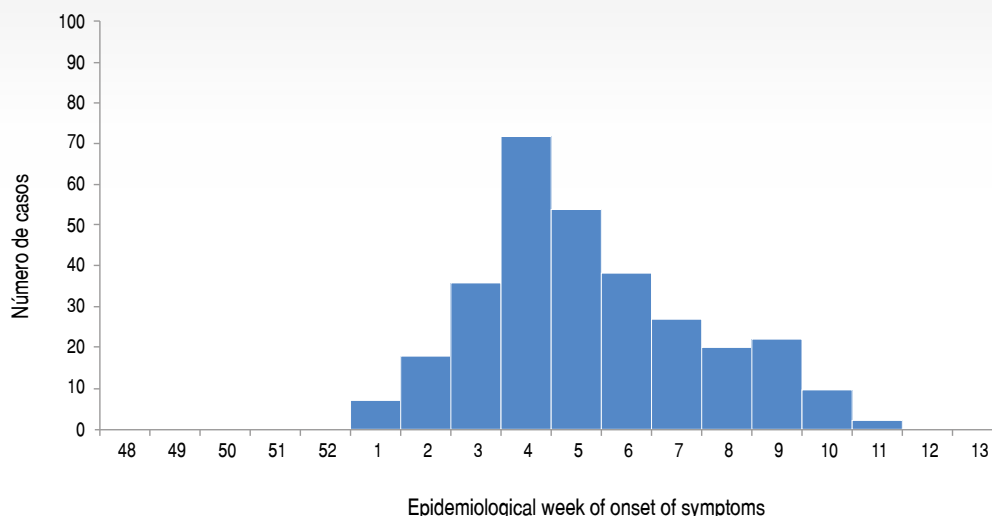
During this period, the number of cases followed a downward trend for a fifth consecutive week in the states of Minas Gerais and Espirito Santo. Figure 18 illustrates the trend of reported cases in the four regional health units that reported 96% of the cases in Minas Gerais, and Figure 19, cases reported in Espirito Santo.

Figure 18. Reported cases of yellow fever, by EW of onset of symptoms, and health region of infection, Minas Gerais, EW 1 to EW 10 of 2017



Source: Data published by the Minas Gerais State Secretariat of Health

Figure 19. Reported cases of yellow fever, by EW of onset of symptoms, Espirito Santo, EW 1 to EW 11 of 2017

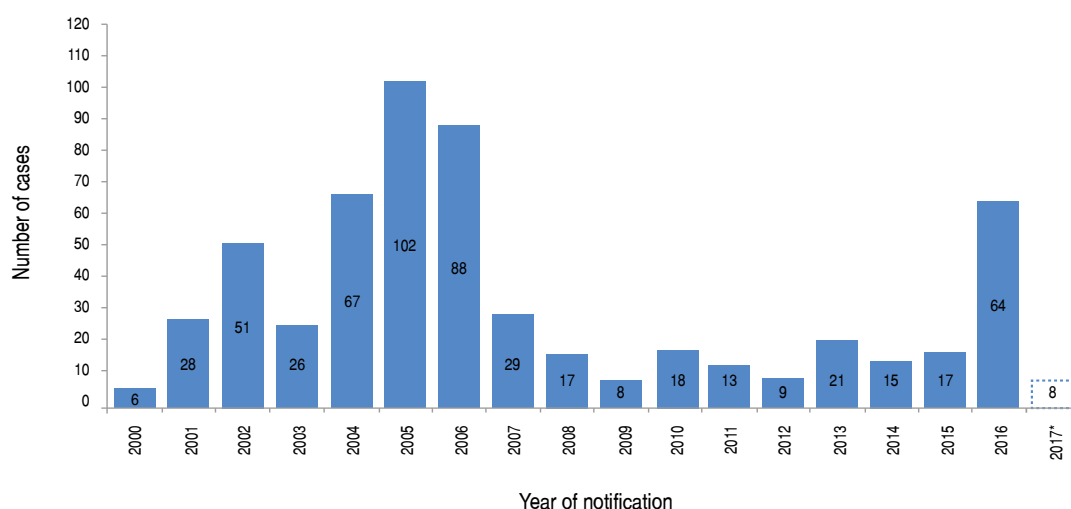


Source: Espirito Santo State Secretariat of Health

Since 16 March 2017, a total of 21 new epizootics were reported in nonhuman primates. From the beginning of the outbreak, and until 17 March, there had been 1,249 epizootics reported, of which 389 had been confirmed as yellow fever; 12 had been discarded; and 382 were still under investigation. The states affected had not changed.

Peru. Up to EW 10 of 2017, there had been 14 cases of yellow fever reported, with 2 deaths. Of the cases, 3 were confirmed, 5 were classified as probable, and 6 had been discarded. Confirmed cases were reported in the Ayacucho department, and the 5 probable cases, in the departments of Amazonas (2 cases), San Martín (1 case), Madre de Dios (1 case), and Pasco (1 case). Figure 20 shows the number of probable and confirmed cases of yellow fever reported in Peru between the years 2000 and 2017.⁴⁰

Figure 20. Number of probable and confirmed cases of yellow fever, Peru, by year reported, 2000 to EW 10 of 2017



Source: Peru Ministry of Health—MINSA, National Center for Epidemiology, Prevention and Disease Control

⁴⁰ The difference between the total number of confirmed and probable cases reported for 2016 in the 23 March 2018 Epidemiological Update and the 16 March 2018 Epidemiological Update is due to adjustments by the Peru Ministry of Health—MINSA, National Center for Epidemiology, Prevention and Disease Control.

3 April 2017⁴¹

No new countries reported cases of yellow fever.

Brazil. From the onset of the outbreak in December 2016 to 29 March 2017, 1,987 cases of yellow fever had been reported: 574 confirmed, 926 discarded, and 487 suspected cases. Among them were 282 deaths (187 confirmed, 24 discarded, and 71 under investigation). The CFR of confirmed cases was 33%.

To this date, 330 municipalities could have been a place of infection. Confirmed cases, however, were limited to 101 municipalities of five states (Espírito Santo, Minas Gerais, Para, Rio de Janeiro, and Sao Paulo). Additionally, 18 cases reported by other federal entities were discarded.

Confirmed cases, by probable place of infection, (for those information was available on): 137 in Minas Gerais (32% CFR); 4 in Sao Paulo (80% CFR), 43 in Espírito Santo (31% CFR), 2 in Para (100% CFR), and 1 in Rio de Janeiro (17% CFR).

The number of cases in Minas Gerais and Espírito Santo continued to follow a downward trend for a fifth consecutive week. In the state of Rio de Janeiro, on the contrary, a growing trend was observed between 9 and 15 March, which then declined. The six autochthonous cases confirmed in Rio de Janeiro were from the Casimiro de Abreu municipality. In addition, during EW 13 of 2017, two autochthonous cases of yellow fever were confirmed in the municipality of Alenquer, state of Para, which is in an area considered of risk for yellow fever. Between July 2014 and May 2016 two cases were confirmed in Para.

Between 23 and 29 March 2017, 1,484 new epizootics were reported in nonhuman primates, which, added to a total of 2,712; 466 had been confirmed as yellow fever, 74 were discarded, and 896 continued under investigation. These epizootics affected the Federal District as well as the states listed in previous paragraphs.

10 April 2017⁴²

No new countries reported cases of yellow fever.

Brazil. Since the onset of the outbreak in December 2016, up to 6 April 2017, a total of 2,210 cases of yellow fever had been reported (604 confirmed, 1,054 discarded, and 552 suspected). Among them, there were 302 deaths (202 confirmed, 52 discarded, and 48 under investigation). Confirmed cases had a 33% CFR.

In total, 342 municipalities had reported cases; however, confirmed cases had been reported in 103 municipalities in five states: Espírito Santo, Minas Gerais, Para, Rio de Janeiro, and Sao Paulo.

Confirmed deaths, by probable place of infection: 148 in Minas Gerais (34% CFR), 4 in Sao Paulo (80% CFR), 43 in Espírito Santo (29% CFR), 4 Para (100% CFR), and 3 in Rio de Janeiro (27% CFR).

In Minas Gerais the number of cases continued to fall, but in Espírito Santo, as of EW 9 of 2017, there was a new increase, mostly in the southern part of the state. To this date, authorities were investigating said increase, and had intensified immunization. In the state of Rio de Janeiro, an increase in the number of suspected cases was also noted between 15 and 25 March. Also,

⁴¹ PAHO/WHO. Epidemiological Update: Yellow Fever. 3 April 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2lcZS35>

⁴² PAHO/WHO. Epidemiological Update: Yellow Fever. 10 April 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2joyEUh>

in EW 13, four autochthonous cases of yellow fever were confirmed in the municipalities of Alenquer (3 cases) and Monte Alegre (1 case), state of Para.

A study by Brazilian researchers⁴³ revealed the virus's genomic sequencing in samples from two brown howler monkeys (*Alouatta guariba clamitans*) of the state of Espirito Santo; the virus belonged to South American genotype I; this genotype had been the most frequently found in previous outbreaks in Brazil.

From the outbreak's onset through 6 April 2017, a total of 2,871 epizootics in nonhuman primates had been reported; of those, 474 were confirmed as yellow fever, 997 were under investigation, and 77 had been discarded. In a correction made by the country to previously published data, 159 epizootics in nonhuman primates were added. These would have occurred, for the most part, between January and April 2017, and were retrospectively recorded. No new states reported epizootics for the current period.

17 April 2017⁴⁴

No new countries reported cases of yellow fever.

Brazil. As of 12 April 2017, the total number of cases of yellow fever reported was 2,422 (623 confirmed, 1,128 discarded, and 671 suspected). Among them there were 326 deaths (209 confirmed, 53 discarded, and 64 under investigation). The CFR among confirmed cases was 34%.

Cases had been reported in 359 municipalities, but confirmed cases were limited to 108 municipalities in the five states previously indicated.

Confirmed deaths, by probable place of infection: 151 in Minas Gerais (34%), 4 in Sao Paulo (80% CFR), 48 in Espirito Santo (31% CFR), 4 in Para (100% CFR), and 2 in Rio de Janeiro (20% CFR).

In Minas Gerais no new suspected cases had been recorded since 23 March 2017, and the date of onset of symptoms of the last confirmed case was 14 March 2017. In Espirito Santo, a second increase in cases started in EW 9 of 2017, with most cases being reported in the state's southern municipalities. Local and state authorities strengthened vaccination activities in the area, and the possibility that additional cases occurred among susceptible populations could not be ruled out.

In Rio de Janeiro, an increase in the number of suspected cases occurred between 15 and 25 March, but no new suspected cases were reported as of 6 April. Of the 10 cases confirmed in that period, 8 probably contracted the infection in the municipality Casimiro de Abreu and 1 in the municipality of Sao Fidelis. The remaining case lived in Porciuncula, but the place of infection was still being investigated.

As of 12 April 2017, 2,949 epizootics in nonhuman primates had been recorded, 473 of which were confirmed as yellow fever; 1,041 were under investigation, and 82 had been discarded. On this date 78 epizootics that occurred between January and April 2017 were retrospectively recorded. The states reporting epizootics did not change from previous dates.

⁴³ Bonaldo MC, Gómez MM, dos Santos AAC, de Abreu FVS, Ferreira-de-Brito A, de Miranda RM, et al. Genome analysis of yellow fever virus of Brazil ongoing outbreak reveals polymorphisms [Submitted]. Mem Inst Oswaldo Cruz E-pub: 4 Apr 2017. doi: 10.1590/0074-02760170134

⁴⁴ PAHO/WHO. Epidemiological Update: Yellow Fever. 17 April 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HISTdW>

25 April 2017⁴⁵

No new countries reported cases of yellow fever.

Brazil. From the onset of the outbreak, in December 2016, to 20 April 2017, 2,900 cases of yellow fever were reported (681 confirmed, 1,451 discarded, and 768 suspected cases). Among them there were 372 deaths (234 confirmed, 103 discarded, and 35 under investigation). The CFR among confirmed cases was 34%.

Cases with information on place of infection pointed to 386 municipalities, although confirmed cases were limited to 115, in six states (Espírito Santo, Minas Gerais, Para, Rio de Janeiro, Sao Paulo and Tocantins). During the current EW, a case of jungle yellow fever was confirmed for the first time in the state of Tocantins in an unvaccinated individual of the municipality of Xambioa, in the northern part of that state.

Confirmed deaths, by probable place of infection, for which information was available: 165 in Minas Gerais (31% CFR), 5 in Sao Paulo (50% CFR), 58 in Espírito Santo (35% CFR), 4 in Para (100% CFR), and 2 in Rio de Janeiro (20% CFR).

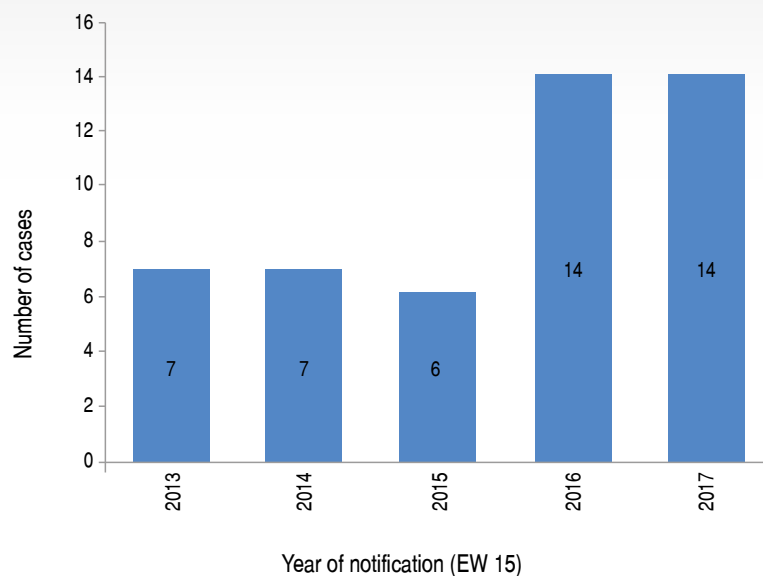
In Espírito Santo, after a second increase in the number of cases earlier reported, a few additional cases continued to be recorded. In addition, the possibility that new confirmed cases might be reported among unvaccinated susceptible populations could not be ruled out. The municipalities that recorded the greatest number of confirmed cases were Ibatiba (22 cases), Colatina (20 cases), and Santa Leopoldina (18 cases). In Tocantins, the case previously confirmed in the municipality of Xambioa was an unvaccinated youth, who worked in the jungle; he passed away in January 2017. This was the first death from yellow fever registered in Tocantins in 17 years.

The number of epizootics continued to increase through 20 April; a total of 3,245 of those events had already been reported in nonhuman primates; of those, 474 were confirmed as yellow fever, 1,277 were being investigated, and 88 were discarded. To this date, the number of states affected remained unchanged.

Peru. As of EW 15 of 2017, a total of 14 cases, including confirmed and probable cases, had been reported, as well as 2 deaths; these numbers were the same for the same period of 2016, but higher than in previous years (Figure 21). Also, as in 2016, the greatest number of confirmed and probable cases were reported in the department of Junin (4 cases), followed by the departments of Ayacucho, Cusco, and San Martín (2 cases each) and Amazonas, Loreto, Madre de Dios, and Pasco, with 1 case each.

⁴⁵ PAHO/WHO. Epidemiological Update: Yellow Fever. 25 April 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HK6ban>

Figure 21. Confirmed and probable cases of yellow fever, reported between EW 1 and EW 15, Peru, 2013 to 2017



Source: Peru Ministry of Health, National Center for Epidemiology, Prevention and Control of Disease.

2 May 2017⁴⁶

No new countries reported cases of yellow fever.

Brazil. From the onset of the outbreak through 27 April 2017, 3,131 cases of yellow fever had been reported (715 confirmed, 1,589 discarded, and 827 suspected). Among them there were 392 deaths (240 confirmed, 113 discarded, and 39 under investigation). The CFR among confirmed cases was 34%.

Reported cases occurred in 399 municipalities, while confirmed cases affected 123 municipalities of six states (Espírito Santo, Minas Gerais, Pará, Rio de Janeiro, Sao Paulo, and Tocantins).

Confirmed deaths, by probable place of infection, for which information was available: 61 in Espírito Santo (30% CFR), 165 in Minas Gerais (34% CFR), 4 in Para (100% CFR), 3 in Rio de Janeiro (27% CFR), and 7 in Sao Paulo (CFR 41%).

In Espírito Santo, most cases were confirmed in the center-south area of the state, and municipalities that concentrated 31% of confirmed cases included Ibatiba (22 cases), Colatina (21 cases) and Santa Leopoldina (20 cases). In Rio de Janeiro, the last case was confirmed on 20 April in the municipality Marica, while in Sao Paulo, the date of onset of symptoms of the last confirmed case was 6 April 2017.

From the beginning of the outbreak through 27 April, a total of 3,467 epizootics of yellow fever in nonhuman primates had been reported, of which 474 were confirmed, 1,367 were under investigation, and 88 had been discarded. States where epizootics occurred remained unchanged.

⁴⁶ PAHO/WHO. Epidemiological Update: Yellow Fever. 2 May 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HMD1Ms>

24 May 2017⁴⁷

No new countries reported cases of yellow fever.

Brazil. From the onset of the outbreak through 18 May 2017, 3,192 cases of yellow fever had been reported (758 confirmed cases, 1,812 discarded, and 622 suspected cases). Among confirmed cases, there were 426 deaths (264 confirmed, 120 discarded, and 42 under investigation). The CFR among confirmed cases was 34.8%.

To this date, cases had been reported in 398 municipalities. Confirmed cases, however, had been reported in 131 municipalities in seven states: Espírito Santo, Goiás, Minas Gerais, Para, Rio de Janeiro, Sao Paulo, and Tocantins.

Confirmed deaths, by probable place of infection, for which information was available: 80 in Espírito Santo, 1 in Goiás, 164 in Minas Gerais; 4 in Para, 5 in Rio de Janeiro, and 10 in Sao Paulo.

The CFR in states with over five confirmed deaths was 34% in Espírito Santo and Minas Gerais, 35% in Rio de Janeiro, and 50% in Sao Paulo.

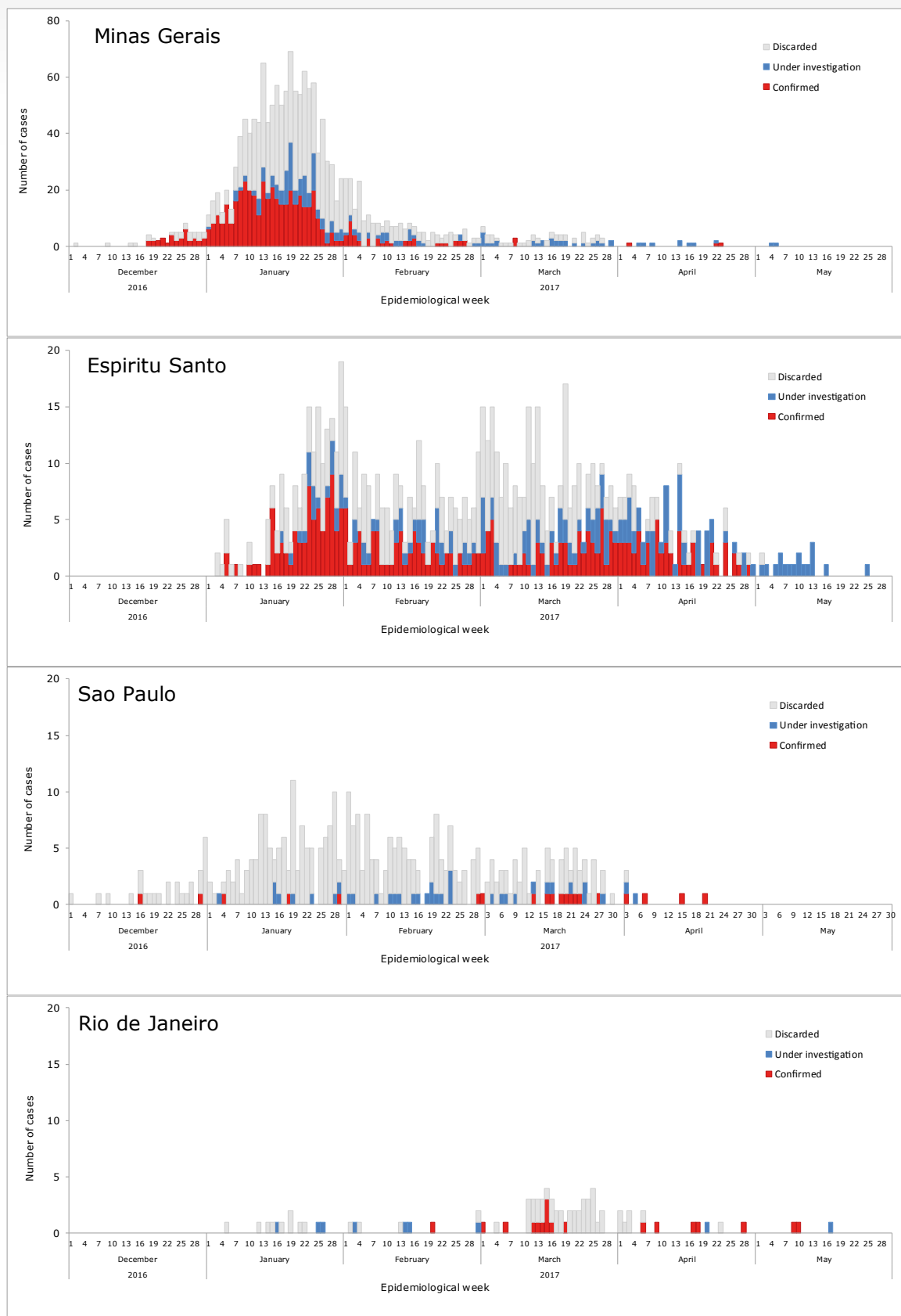
In Espírito Santo, Minas Gerais, and Sao Paulo, no new municipalities had reported confirmed cases. Dates of onset of symptoms among most recently confirmed cases were 24 April, 14 March and 19 April, respectively, for those states. In Para the number of confirmed cases remained at four by EW 13 of 2017. One case was confirmed in the state of Goiás, in an area of risk for yellow fever.

In the state of Bahia, no human cases had been confirmed during 2017 (up to 8 May), but 255 epizootics had been recorded in 78 municipalities. Of the total number of epizootics, 54 were confirmed as yellow fever in 28 municipalities, 4 of them in neighborhoods of the city of Salvador.

Figure 22 illustrates the trend of the number of reported cases, by classification (confirmed, discarded, under investigation) in the four states that concentrate 99% of all confirmed cases.

⁴⁷ PAHO/WHO. Epidemiological Update: Yellow Fever. 24 May 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2w6hkwx>

Figure 22. Reported cases of yellow fever, by date of onset of symptoms, and probable state of infection, Brazil, 1 December 2016 to 18 May 2017



Source: Data published by Brazil Ministry of Health

From the beginning of the outbreak through 18 May, 3,660 deaths of nonhuman primates had been reported, of which 565 had been confirmed as yellow fever, 96 had been discarded, and 1,467 continued to be investigated. No new states affected by these epizootics were reported.

Cumulative number of doses of vaccines distributed to the states of Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo: 24.5 million.

These vaccines were intended to intensify selective vaccination in 1,028 municipalities of the states affected. Through 18 May 2017, 285 municipalities had achieved $\geq 95\%$ administrative coverage; in 375 municipalities the coverage was between 75 and 94.9%, and in 368 municipalities, the coverage was less than 75%. Among the latter, there were 92 municipalities where coverage was below 50%.

10 July 2017⁴⁸

No new countries reported cases of yellow fever.

Brazil. Through 31 May 2017, 3,240 cases of yellow fever had been reported (792 confirmed, 1,929 discarded, and 519 under investigation), with 435 deaths (274 confirmed, 124 discarded, and 37 under investigation). The CFR among confirmed cases was 35%.

Suspected cases had been reported in 407 municipalities; confirmed cases, however, were reported in 130 municipalities of the Federal District and eight states:⁴⁹ Espirito Santo, Goias, Mato Grosso, Minas Gerais, Para, Rio de Janeiro, Sao Paulo, and Tocantins.

Confirmed deaths, by probable place of infection: 1 in the Federal District, 85 in Espirito Santo, 1 in Goias, 1 in Mato Grosso, 165 in Minas Gerais, 4 in Para, 7 in Rio de Janeiro, and 10 in Sao Paulo.

In states with over five confirmed deaths, the CFR among confirmed cases was: 50% in Sao Paulo, 41% in Rio de Janeiro, 34% in Minas Gerais, and 33% in Espirito Santo.

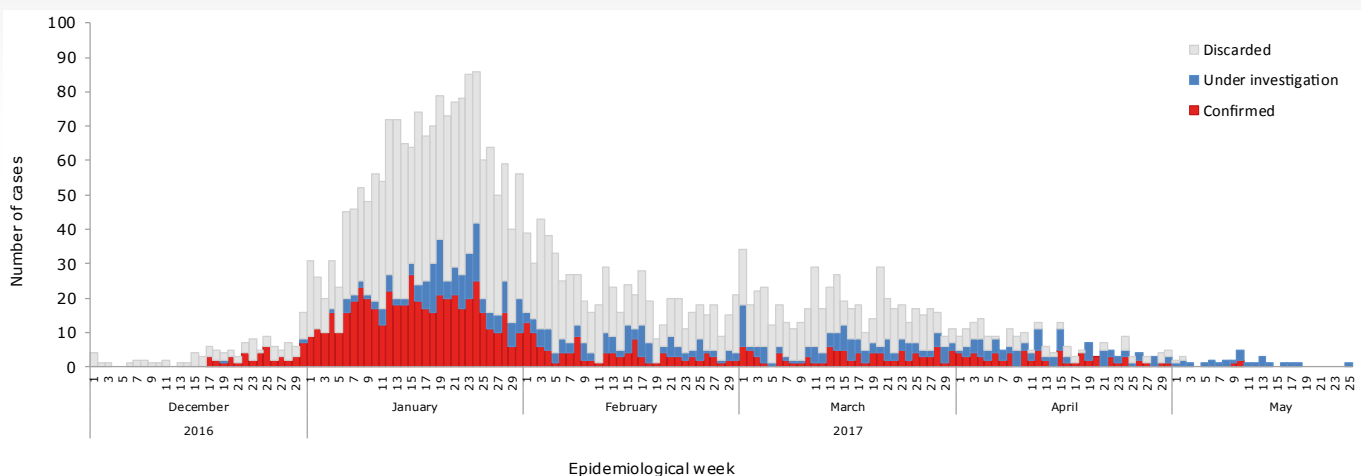
In Espirito Santo, Minas Gerais, Sao Paulo, and Rio de Janeiro, no new municipalities had reported confirmed cases of yellow fever for the last month, and the date of onset of symptoms among most recent cases for 2017 was: 18 April in Minas Gerais, 19 April in Sao Paulo, 29 April in Espirito Santo, and 10 May in Rio de Janeiro. In Para, the number of confirmed cases remained at four in EW 13 of 2017, and in Tocantins, one case was confirmed in EW 16 of 2017. There was also one confirmed case in Goias, and another in Mato Grosso, in a known area of risk for yellow fever. Although to date, in Bahia, there had been no confirmed cases, from the beginning of the year up to 8 May 2017, there 255 epizootics had been recorded in 78 municipalities. Of those, 54 epizootics in 28 municipalities were positive for yellow fever by RT-PCR, 4 of them in neighborhoods of Salvador.

Figure 23 shows the trend of the number of reported cases, by classification (confirmed, discarded, suspected, or under investigation) in Brazil.

⁴⁸ PAHO/WHO. Epidemiological Update: Yellow Fever. 10 July 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2FCsCs9>

⁴⁹ Additionally, 12 cases were discarded in other federative entities.

Figure 23. Reported cases of yellow fever, by onset of symptoms and case classification, Brazil, 1 December 2016 to 31 May 2017



Source: Brazil Ministry of Health

As of 31 May, the total number of epizootics in nonhuman primates reached to 3,850, of which 642 had been confirmed as yellow fever, 96 had been discarded, and 1,448 were under investigation. Those epizootics had been detected and reported in the same states as before.

Cumulative number of doses of vaccines distributed to the states of Bahia, Espirito Santo, Minas Gerais, Sao Paulo, and Rio de Janeiro: 26.3 million.

Selective vaccination was planned for 1,050 municipalities of the affected states. Up to 31 May, in 192 (this number was 285 municipalities the Brazil report of the previous week) municipalities the administrative vaccination coverage was $\geq 95\%$; in 381 municipalities, the coverage was between 75 and 94.9%, and in 477 municipalities, the coverage was less than 75%. Among the latter, 126 municipalities did not reach 50% coverage.

Bolivia. A new case of yellow fever was confirmed in EW 25 of 2017, bringing the number of confirmed cases to two for the year. The most recent case probably contracted the infection in the municipality of Villa Tunari, department of Cochabamba, where this would be the first case reported since 2013. The case previously confirmed in 2017 had probably acquired the infection in the Caranavi municipality, department of La Paz. In both departments the places of infection are known risk areas for yellow fever.

Ecuador. In EW 8, EW 20, and EW 26 of 2017, three fatal cases of yellow fever were reported; all three were male adults, without vaccination history, who contracted the infection in the province of Sucumbios.

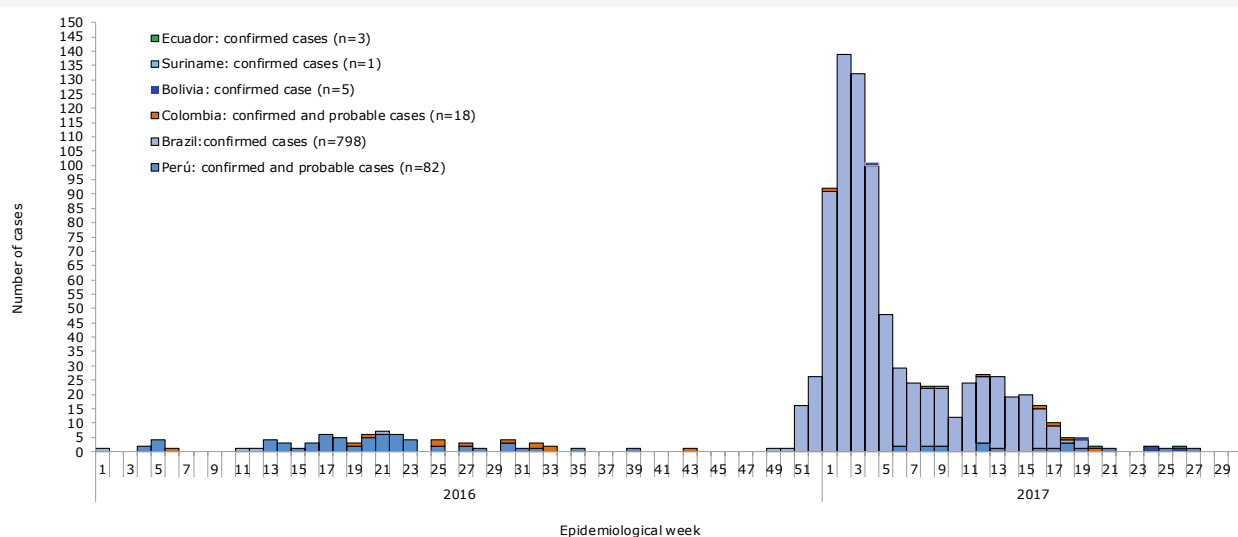
Peru. Until EW 24 of 2017, there were 20 cases of yellow fever reported, including confirmed and probable cases, and 3 deaths. As in 2016, most cases occurred in the department of Junin.

2 August 2017⁵⁰

Between EW 1 of 2016 and EW 30 of 2017, suspected and confirmed cases of yellow fever had been reported in Bolivia, Brazil, Colombia, Ecuador, Peru, and Suriname (Figure 24).

⁵⁰ PAHO/WHO. Epidemiological Update: Yellow Fever. 2 August 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2FC1idv>

Figure 24. Confirmed and probable cases of yellow fever in the Americas, by country, EW 1 of 2016 to EW 30 of 2017



Source: The IHR NFPs of Bolivia, Ecuador, Peru, and Suriname provided their respective data to PAHO/WHO. Brazil data estimated based on information published in the Brazil Yellow Fever Report; Monitoring of yellow fever cases and deaths in Brazil - Report 43. Available at: <http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/leia-mais-o-ministerio/619-secretaria-svs/11-svs/27300-febre-amarela-informacao-e-orientacao> Colombia data from the Colombia Weekly Epidemiological Bulletins of EW 52 of 2016 and EW 25 of 2017. Available at: <http://www.ins.gov.co/boletin-epidemiologico/Paginas/default.aspx>

Bolivia. Between EW 3 and EW 30 of 2017, five cases of yellow fever were confirmed, including three deaths (60% CFR). None of the cases had history of vaccination against yellow fever, and all had been infected in areas of risk of transmission in the departments of La Paz (4 cases) and Cochabamba (1 case). The age of the cases ranged between 9 and 48 years, and four were male.

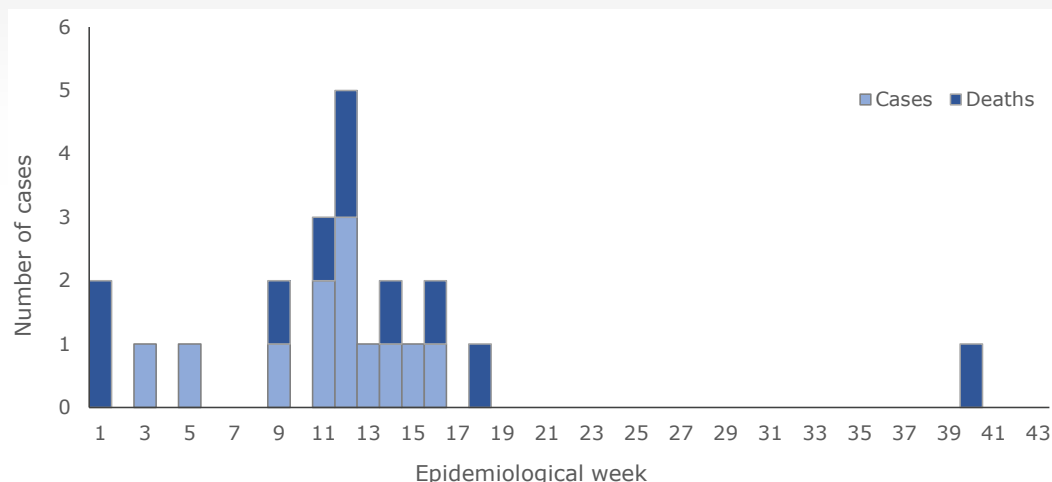
27 October 2017⁵¹

From the onset of the outbreak in 2016, through EW 43 of 2017, suspected and confirmed cases of yellow fever had been reported in Bolivia, Brazil, Colombia, Ecuador, French Guiana, Peru, and Suriname. In the period between 2 and 27 August of the same year, only Brazil, French Guiana, and Peru reported new cases.

Brazil. From July 2017 to date, the state of Sao Paulo reported 37 suspected of yellow fever cases (1 fatal confirmed case, 3 under investigation, and 33 discarded). The fatal confirmed case was reported in EW 40 of 2017 in a 76-year-old male, from an area between Itatiba and Jundiai. Figure 25 shows the distribution of confirmed cases from the beginning of the year through the date of this report.

⁵¹ PAHO/WHO. Epidemiological Update: Yellow Fever. 27 October 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2y98qz9>

Figure 25. Confirmed cases of yellow fever, by EW, state of Sao Paulo, EW 1 to EW 43 of 2017



Source: Sao Paulo State Health Secretariat.

Between January and mid October 2017, the state of Sao Paulo reported 1,260 epizootics, with an increase in the number of reports starting as of EW 37 of that year. Yellow fever was confirmed in 258 nonhuman primates, 248 (96%) of which were reported in the region of Campinas. Yellow fever virus was also detected in new areas of the state, and confirmed for the first time in cases in nonhuman primates in the municipalities Campo Limpo Paulista (EW 38), Atibaia (EW 39), Jarinu (EW 41), and in the city of Sao Paulo—urban area (EW 41). Because of this finding, the Municipal Health Secretariat, together with the government of the state of Sao Paulo, initiated the vaccination of residents in the area around the epizootic.

French Guiana. In EW 34 of 2017, the France IHR NFP reported a confirmed case of yellow fever registered in French Guiana, in a 43-year-old Brazilian woman of unknown vaccination status. The patient was hospitalized on 7 August 2017, and died two days later in a hospital in Cayenne; the patient developed fulminant hepatitis. The infection might have been contracted in an area of gold exploration near St. Elie (center-north of the department); the patient’s travel history was still under investigation. This was the first confirmed case of yellow fever in French Guiana since 1998.

Peru. Between EW 1 and EW 41 of 2017, 16 cases of yellow fever were reported, including confirmed and probable cases, and three deaths. As in 2016, most cases occurred in the department of Junin.

13 December 2017⁵²

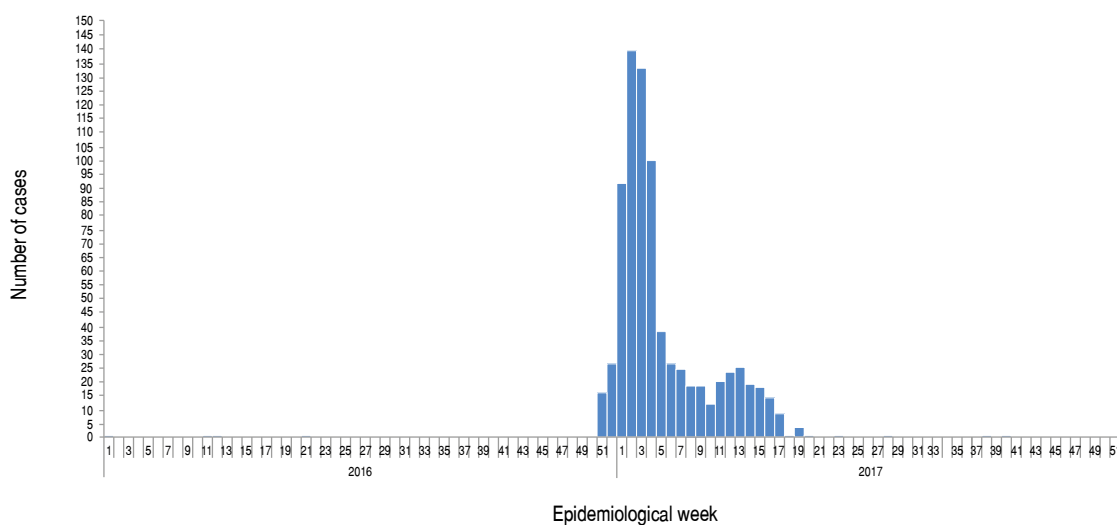
Between 27 October and 13 December 2017, Brazil and Peru reported new cases of yellow fever.

Brazil. The yellow fever outbreak reported between the second semester of 2016 and June 2017, with 779 confirmed cases, 262 deaths, and 1,659 epizootics, was followed by a period of limited transmission. Confirmed cases were reported in EW 28, EW 38, and EW 40 of 2017, in the states of Sao Paulo (2 cases) and Rio de Janeiro (1 case). The cases confirmed in Sao Paulo, one in EW 38 and another in EW 40 (fatal case in a 76-year-old male), were probably

⁵² PAHO/WHO. Epidemiological Update: Yellow Fever. 13 December 2017, Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HMrrsA>

infected in the municipality of Itatiba, while that of Rio de Janeiro was probably infected in the Guapimirim municipality. Figure 26 illustrates the distribution of confirmed cases between EW 1 of 2016 and EW 49 of 2017. Brazilian health authorities reported an ongoing investigation of 1 case who was probably infected in Brasilia, Federal District, in an epizootic area; 2 cases in the state of Rio Grande do Sul, and 2 in Santa Catarina. There were 37 additional cases under investigation in other states.

Figure 26. Confirmed cases of yellow fever, by EW, Brazil, EW 1 of 2016 to EW 49 of 2017

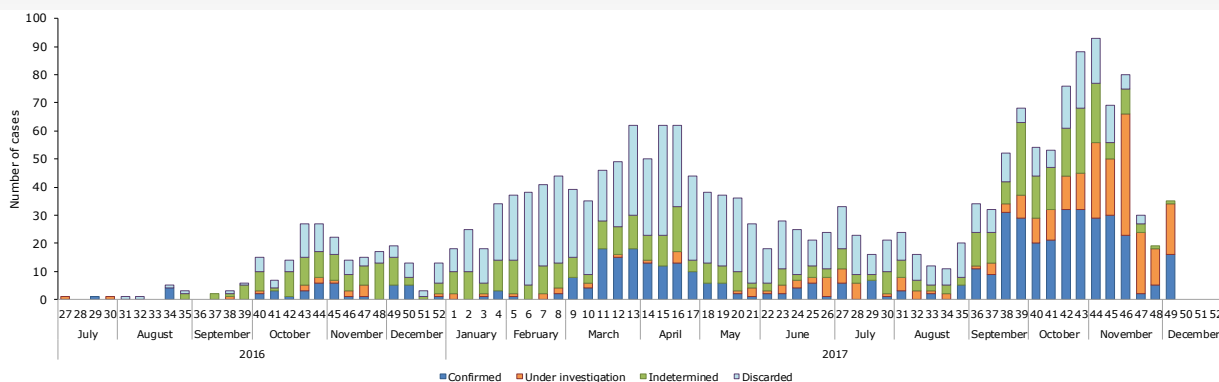


Source: Brazil Ministry of Health

Between July and EW 49 of 2017, 1,661 epizootics had been reported, as follows: 144 confirmed as yellow fever; 628 indeterminate (no samples were collected); 703 under investigation; and 186 discarded. The greatest number of confirmed epizootics was recorded in Sao Paulo (120), but those events were also confirmed in Mato Grosso (1), Minas Gerais (21), and Rio de Janeiro (2). Confirmed epizootics in Minas Gerais and Sao Paulo occurred in the same areas affected by the outbreak of 2016-2017, and are an indication of persistent risk of human transmission.

In Sao Paulo, transmission mainly affected the area of Campinas. The number of epizootics confirmed as yellow fever between July and December 2017 was greater than that between July 2016 and June 2017. Figure 27 shows confirmed epizootics of yellow fever during every month of the year, even in those months with low temperatures and non-propitious climatic conditions for viral transmission. The increase in the number of cases of yellow fever confirmed in nonhuman primates between July and December 2017, and the expansion of virus detection into areas where it had not been previously detected, such as the municipality of Sao Paulo and six municipalities of Greater Sao Paulo (Cajamar, Caieiras, Mairipora, Franco da Rocha, Guarulhos, and Itapeceira da Serra), indicated a high degree of viral activity, with the consequent risk of transmission among non-immunized populations. In response to this situation, and to prevent transmission among humans, the Municipal Secretariat of Health and the state of Sao Paulo intensified the vaccination of residents in areas where epizootics occurred and their vicinity in the Sao Paulo municipality. Epizootics in that municipality occurred in an outlying area which borders forest fragments, where vectors of the wild virus transmission cycle are found.

Figure 27. Epizootics in nonhuman primates, by EW, by classification, state of Sao Paulo, EW 27 of 2016 to EW 49 of 2017

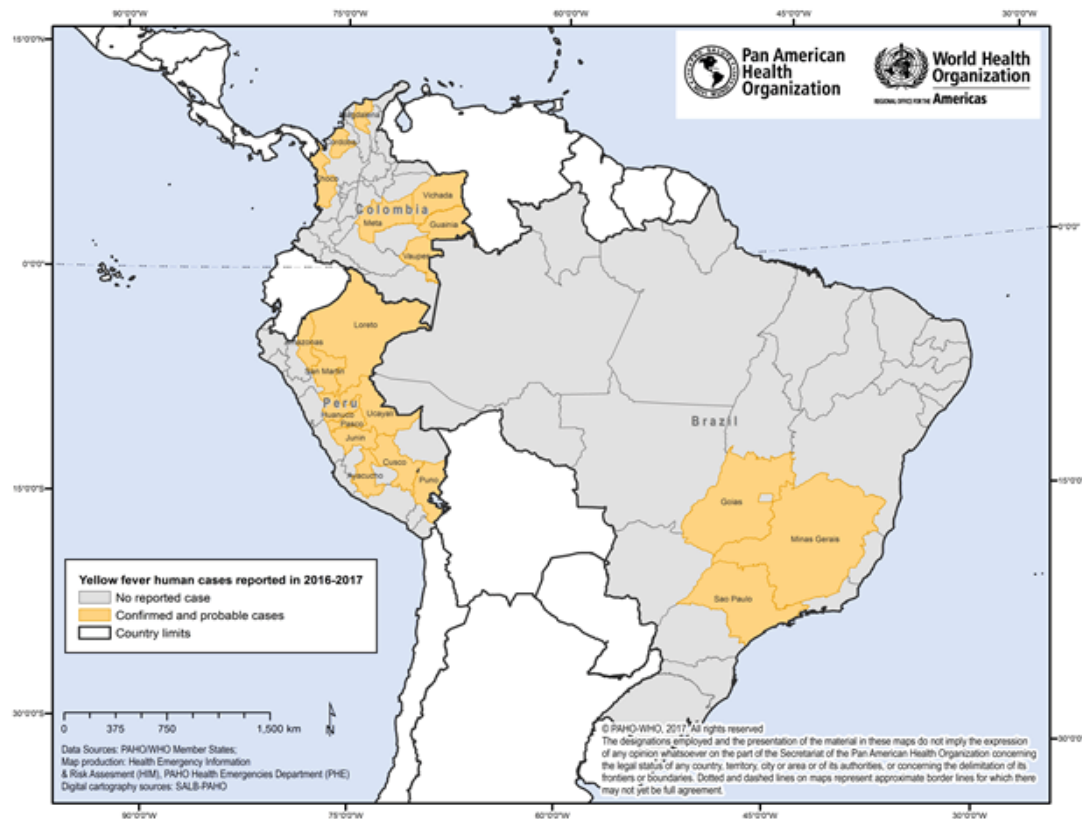


Source: Ministry of Health of the state of Sao Paulo.

Peru. From EW 1 through EW 44 of 2017, 17 confirmed and probable cases of yellow fever were reported, including three deaths⁵³. As in 2016, most 2017 cases were detected in the department of Junin (6 cases).

Figure 28 shows geographical areas affected by yellow fever outbreaks in the period 2016-2017 in the Region of the Americas.

Figure 28. Probable and confirmed cases of yellow fever reported in the Americas during 2016 and 2017, by place



⁵³ Peru Ministry of Health. Yellow fever EW44 of 2017. Available at: <http://www.dge.gob.pe/portal/docs/vigilancia/sala/2017/salaSE44.pdf>.

Recommendations

Considering the increase in the number of confirmed yellow fever cases and epizootics in countries of the Region, PAHO/WHO urges Member States to continue efforts to detect, confirm, and adequately and timely treat cases of yellow fever. To this end, health care workers should be kept up-to-date and trained to detect and treat cases, especially, in areas of known virus circulation.

PAHO/WHO urged Member States to take proper measures to inform and ensure vaccination of travelers heading to areas where certification of yellow fever vaccine is mandatory.

Considering that a decade ago yellow fever outbreaks and epizootic waves affecting southeastern and southern Brazil subsequently reached Argentina and Paraguay, monitoring the behavior of yellow fever in those areas was deemed necessary during 2017-2018.

PAHO/WHO does not recommend any restrictions on travel or trade to countries with ongoing outbreaks of yellow fever.

Below are key recommendations related to yellow fever issued in the Epidemiological Alert on Yellow Fever published on 31 December 2015⁵⁴, with respect to surveillance, clinical management, and prevention and control measures. The recommendations for laboratory diagnosis appear further down.

Surveillance

Yellow fever epidemiological surveillance must be aimed at (i) achieving early detection of virus circulation to enable timely adoption of appropriate control measures to prevent the occurrence of new cases; (ii) interrupting outbreaks; and (iii) preventing the re-urbanization of the disease.

The method of surveillance should be a combination of:

- Surveillance of clinically compatible cases with the classic form of the disease, based on WHO case definitions
- Surveillance of febrile jaundice syndrome
- Surveillance of epizootics
- Monitoring post-vaccination events allegedly attributable to yellow fever vaccination

Surveillance of febrile jaundice syndrome, usually through sentinel sites, uses a more sensitive case definition and rules out cases through laboratory testing.

Biosafety

Serum samples from acute phase are considered infectious. All laboratory personnel who manage yellow fever samples in a laboratory setting must be vaccinated against yellow fever. The use of Class II certified biosafety cabinets for the handling of samples, is also recommended, as well as exercising caution and avoid puncture accidents.

Given the differential diagnosis of yellow fever, which includes hemorrhagic fevers caused by arenaviruses, samples should be handled under BSL3 containment conditions, and a risk assessment and analysis of the medical history should be conducted before handling samples in the laboratory. See also recommendations on laboratory diagnosis further down.

⁵⁴ PAHO/WHO. Epidemiological Update: Yellow Fever. 31 December 2015, Washington, D.C.: PAHO/WHO; 2015. Available at: <https://bit.ly/2qKTv8m>

Clinical management

There is no specific antiviral treatment for yellow fever; therefore, supportive therapy is critical. Severe cases should be treated in intensive care units. General supportive therapy with administration of oxygen, intravenous fluids, and vasopressors is indicated to treat hypotension and metabolic acidosis. Gastric protectors should be included to reduce the risk of gastrointestinal bleeding.

Treatment in severe cases includes mechanical ventilation, treatment of disseminated intravascular coagulation, use of frozen fresh plasma to treat hemorrhage, treatment of secondary infections with antibiotics, and management of liver and kidney failure. Other supportive measures include the use of nasogastric tube for nutritional support or prevention of gastric distention, and dialysis for renal failure or patient with refractory acidosis.

In mild cases the symptoms are treated. Salicylates should not be used, as they can produce hemorrhage.

Differential diagnosis

The different clinical forms of yellow fever must be differentiated from other febrile diseases that progress with jaundice, hemorrhagic manifestations, or both. In the Americas, the following diseases should be considered in the differential diagnosis of yellow fever: leptospirosis; severe malaria; viral hepatitis, especially the fulminating form of hepatitis B and D; viral hemorrhagic fevers;⁵⁵ dengue; typhoid fever; typhus, and hepatic toxicity or secondary fulminant hepatitis to toxic drugs.

Patient Isolation

To prevent infection of other persons, a patient infected with yellow fever virus should avoid bites by the *Aedes* mosquito at least for the first 5 days of illness (viremic phase). The patient is advised to stay under a bed net (treated insecticide or not) or stay in a place with intact window/door screens. In addition, health care personnel taking care of patients with yellow fever should be protected from mosquito bites by using repellents and wearing long sleeves and pants.

Prevention and control measures

Vaccination

Vaccination is the single and key measure for preventing yellow fever. Preventive vaccination can be administered as part of a child's routine immunization schedule, or in one-time mass campaigns to increase vaccination coverage in risk areas, as well as for travelers to yellow fever risk areas.

The yellow fever vaccine is safe and affordable, providing effective immunity against yellow fever within 10 days of administration for 80-100% of vaccines, and 99% immunity within 30 days. A single dose of yellow fever vaccine is sufficient to confer sustained immunity and life-long protection against yellow fever disease; a booster dose of yellow fever vaccine is not needed. Serious adverse events have rarely been reported following immunization.

Precautions:

The epidemiological risk of contracting the disease versus the risk of adverse events in people over 60 years of age who have not been previously vaccinated should be evaluated on a case by case vis-a-vis the risk of adverse events.

⁵⁵ If hemorrhagic fever is suspected, appropriate control measures should be implemented.

- The vaccine can be offered to individuals with asymptomatic HIV infection with CD4+ counts ≥ 200 cells / mm³ requiring vaccination.
- Pregnant women should be vaccinated in emergency epidemiological situations and following the explicit recommendations of health authorities.
- Vaccination is recommended in nursing women who live in endemic areas, since the potential risk of transmitting the vaccine virus to the child is far lower than the benefits of breastfeeding.
- For pregnant or lactating women traveling to areas with yellow fever transmission, vaccination is recommended when travel cannot be postponed or avoided. They should receive advice on the potential benefits and risks of vaccination to make an informed decision. The benefits of breastfeeding are superior to those of other nutritional alternatives.

The following people are usually excluded from yellow fever vaccination:

- Immunocompromised individuals (Including those with thymus disorders, symptomatic HIV, malignant neoplasms under treatment, and those that are receiving or have received immunosuppressive or immunomodulatory treatments, recent transplants, and current or recent radiation therapy).
- People with severe allergies to eggs and their derivatives.

PAHO/WHO recommends that national authorities:

1. Make an evaluation of yellow fever vaccination coverage in risk areas at municipal level, to guarantee at least 95% coverage in the population residing in those areas
2. Member States that are not currently facing outbreaks should not conduct indiscriminate vaccination campaigns. The use of vaccines in susceptible population should be prioritized, and revaccination, avoided.
3. Ensure the vaccination of all the travelers to endemic areas at least 10 days before traveling.
4. It is recommended that a small reserve stock be kept according to the availability of vaccines, to be able to respond to outbreaks, when necessary.
5. Postpone the current vaccination of children of non-endemic areas until enough vaccines are available. Once vaccines become available, a vaccination update should be implemented to complete vaccination schedules.

Vector Control

The risk of transmission of yellow fever in urban areas can be reduced through an effective vector control strategy. Combined with emergency vaccination campaigns, the application of insecticides to kill adult mosquitoes during urban epidemics can reduce or halt yellow fever transmission, while populations are vaccinated to acquire immunity.

Mosquito control programs targeting wild mosquitos in forested areas are not practical for preventing jungle yellow fever transmission.

Travelers

Recommendations for travelers who plan to visit areas of risk for yellow fever transmission in Brazil include: the vaccination against yellow fever at least 10 days before the trip; instructions

on measures to avoid mosquito bites; information on the symptoms and signs of yellow fever, and advise to the traveler so that, if signs and symptoms of the disease appear during a trip to a zone at risk for transmission or upon the traveler's return, health care should be sought, especially in a country where a cycle of local transmission could be established (i.e., where the competent vector is present).

As provided for in Annex 7 of the International Health Regulations (IHR), that were amended and became effective in July 2016, pursuant to Resolution WHA67.13, **a single dose of yellow fever vaccine is required in order to confer immunity and permanent protection against yellow fever disease.** Booster doses of yellow fever are not needed.

If, on medical ground, a traveler cannot receive the yellow fever vaccine, this must be certified by the relevant authorities as per Annex 6 and Annex 7 of the IHR.

Specific recommendations on the diagnosis of yellow fever in the Region of the Americas⁵⁶

Yellow fever virus belongs to the genus *Flavivirus* and is related to other viruses of the same genus, such as dengue, Zika, Japanese encephalitis, and West Nile viruses. The virus is transmitted to humans, mainly, by sylvatic mosquito vectors of the genera *Haemagogus* and *Sabethes*, as well as the *Aedes aegypti* mosquito. The clinical presentation of yellow fever ranges from asymptomatic or mild infection to potentially fatal severe conditions with hemorrhage and jaundice. The diagnosis of a suspected case of yellow fever is based on patients' clinical manifestations, place(s) and date(s) of travel (if the patient is from a non-endemic country or area), activities, and the epidemiological history of location where the presumed infection occurred. Laboratory confirmation is necessary to characterize cases and outbreaks.

Laboratory diagnosis of the yellow fever virus infection

Type of laboratory sample and procedures

Yellow fever diagnosis is made by virological methods (detection of the virus or its genetic material in serum or tissue), by means of viral isolation or RT-PCR, or by means of serological testing for antibody detection.

Biosafety considerations

All biological samples (whole blood, serum or fresh tissue) should be considered as potentially infectious. All laboratory personnel handling these samples must be vaccinated against yellow fever and use appropriate personal protective equipment. Likewise, it is recommended to carry out all procedures in certified Class II biosafety cabinets, and to take all necessary precautions to avoid percutaneous exposure. Procedures for handling non-human samples should be carefully assessed according to the laboratory's biosafety manual; the use of Class III biosafety cabinets should be considered.

Virological diagnosis

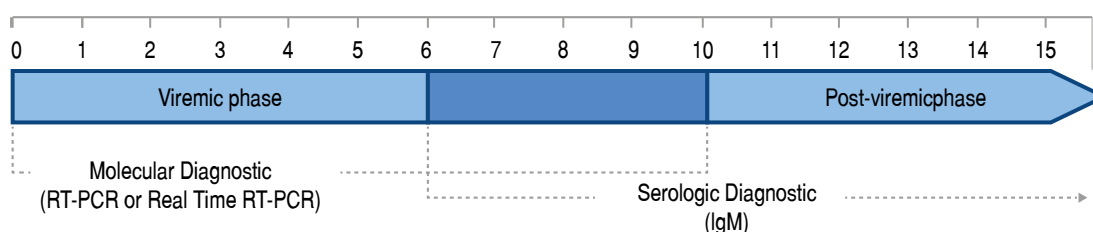
- ❶ Molecular diagnosis: Viral RNA can be detected during the first 5 days from symptom onset (viremic phase) using molecular techniques, such as end-point of real-time RT-PCR. Occasionally, viral RNA can be detected up to 7 days from symptom onset. Thus, it is recommended to perform both RT-PCR and IgM ELISA for samples collected between

⁵⁶ The full report is available at: <https://bit.ly/2FnIXBG>

days 5 and 7 from the onset of symptom (Figure 29). A positive result (when using the appropriate controls) confirms the diagnosis.

- ❶ Viral isolation: Viral isolation can be performed through intracerebral inoculation in mice or in cell culture. However, because of its complexity, this methodology is rarely used as a diagnostic tool and it is recommended mainly for research studies complementary to public health surveillance.
- ❷ Postmortem Diagnosis: Histopathological analysis with immunohistochemistry performed on liver sections is considered the “gold standard” for the diagnosis of yellow fever in fatal cases. Additionally, molecular detection can also be performed in fresh or paraffin-embedded tissue samples to confirm cases. The procedure may be carried out under Biosafety Level 2 (BSL2) containment (see above the section Biosafety considerations for non-human samples).

Figure 29. Indications for yellow fever diagnosis according to the number of days since the onset of symptoms



Serological diagnosis

Serology (the detection of specific antibodies) is useful for diagnosing yellow fever during the post-viremic phase of the disease (i.e., 5th day from the onset of symptoms).

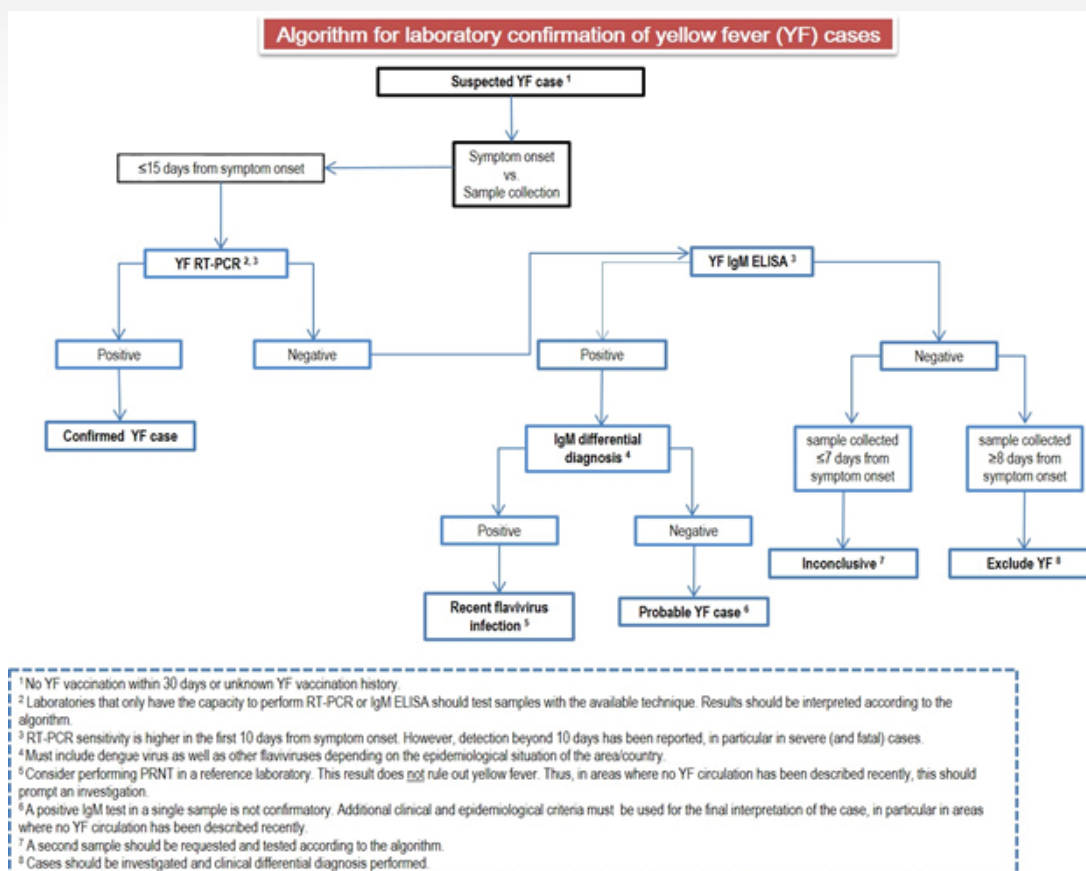
A positive IgM reaction by enzyme-linked immunosorbent assay (ELISA) (mainly IgM antibody-capture, MAC-ELISA) or any other immunoassay (indirect immunofluorescence) in a sample collected from the 5th day of symptom onset is presumptive of recent yellow fever virus infection. Currently, there are not commercially available, validated IgM ELISA kits. Therefore, in-house protocols using whole purified antigen may be standardized.

The confirmation of a case of yellow fever by ELISA IgM will depend on the epidemiological situation and on the result of the differential laboratory diagnosis. In areas where other flaviviruses circulate (mainly dengue and Zika), the probability cross-reactivity is higher (Figure 30).

Other serological techniques include the detection of IgG antibodies by ELISA and of neutralizing antibodies by plaque reduction neutralization test (PRNT). The first one is useful with coupled samples (taken at least 1 week apart), while PRNT (90%) can be useful with coupled samples or with a single post-viremic sample, provided that the test includes multiple flaviviruses.

Seroconversion (negative results in the first sample and positive result in the second sample), a more than 4-fold increase in antibody titers in paired samples, or a detectable antibody titer against yellow fever in a post-viremic sample by PRNT90 is presumptive of yellow fever virus infection. Confirmation of a yellow fever case using these techniques will depend on the epidemiological situation and the results of laboratory differential diagnosis. In areas with co-circulation of other flaviviruses the probability of cross reactivity is higher (Figure 30). Additionally, in those areas where active vaccination campaigns are ongoing, detection of vaccine induced antibodies may occur, so diagnostic tests should be cautiously interpreted. (See post-vaccination immune response, below.)

Figure 30. Algorithm for the laboratory confirmation of yellow fever cases



Interpretation of serology results and differential diagnosis

Serological techniques are often cross-reactive among flavivirus infections (particularly, in secondary flavivirus infections). This should be considered in areas with cocirculation of yellow fever virus with other flaviviruses (dengue, St. Louis encephalitis, Zika, and others of the Japanese encephalitis complex) is documented and the population is likely to have been previously infected with these viruses. Also, it should be noted that in individuals vaccinated against yellow fever, vaccine-induced IgM can be detected for several months or even years.

Therefore, it is recommended to conduct the parallel detection of antibodies to other flaviviruses and to carefully interpret the results, taking into consideration the individual vaccination history, as well as available epidemiological information.

In general, the PRNT offers greater specificity than IgM and IgG detection. However, cross-reactivity has also been documented for the neutralization assays. Thus, it is also recommended that this technique be performed using antigens for several flaviviruses.

Moreover, the differential diagnosis of yellow fever should include other febrile and febrile icteric syndromes – such as dengue, leptospirosis, malaria, viral hepatitis, among others – depending on the epidemiological profile of the affected country or area.

A case of yellow fever will be confirmed by serological techniques only if the differential laboratory diagnosis, taking into consideration the epidemiological situation of the country, is negative for another flavivirus.

Post-vaccination immune response

Vaccination induces a relatively low viremia that decreases after 4 to 7 days. Concurrently, an IgM response develops. This response cannot be differentiated from the IgM response induced by natural infection. Approximately 10 days after vaccination, the vaccinated individual is considered to be protected against a natural infection. The IgM response may be detected from around day 5 onwards with a peak occurring generally 2 weeks after vaccination. Subsequently, antibody levels tend to decrease. However, in a significant proportion of individuals, the IgM response can be detected one month after vaccination, and in some cases (mainly travelers) up to 3 to 4 years following vaccination. In addition, neutralizing antibodies induced by vaccination can be detected for several decades. Therefore, the interpretation of serological results in vaccinated individuals is complex, particularly in those who have recently been vaccinated and results should be carefully assessed.

Sample conservation

To conserve the samples appropriately:

- Whole blood (in EDTA tube) or serum (red-top tube) should be kept refrigerated (2 - 8 °C) if processed (or sent to a reference laboratory) within 48 hours.
- Serum should be kept frozen (-10 to -20 °C) if processed after 48 hours, but no more than 7 days.
- Serum should be kept frozen (-70 °C) if processed more than a week after. Serum samples can be stored at -70 °C for extended periods of time.
- Multiple freeze-thaw cycles should be avoided.
- Fresh tissue samples (approximately 1 cm³) can be used for molecular diagnosis. Freeze at -70 °C and send to a reference laboratory on dry ice. If not possible, store fresh tissue in sterile saline or refrigerated phosphate buffered saline (PBS) (2 to 8 °C) and ship with refrigerant gels.
- For histopathological and immunohistochemistry analyses, tissue samples (approximately 1 cm³) must be fixed in buffered formalin and sent to a pathology laboratory at room temperature. Liver is the tissue of choice for histopathological and immunohistochemistry analyses. Spleen and kidney samples may also be useful.

Shipping of samples to the reference laboratory by air

Following are some aspects to consider for shipping samples by air:

- The cold chain should be maintained with dry ice (if possible) or with refrigerant gel. Triple packaging should always be used.
- Samples should be shipped, if possible, within the first 48 hours.
- The original samples must be packaged, marked, labeled (if dry ice is used) and registered as category B.
- The shipment must be accompanied by the complete clinical and epidemiological record.

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Zika

12 January 2017⁵⁷

Note: As of 1 September 2016, a weekly publication of the number of confirmed cases of congenital syndrome in the form of a table was begun at: <https://bit.ly/2I3EKrS>.

Incidence and trends

Between EW 44 of 2016 and the date of this report, no additional countries or territories in the Americas confirmed autochthonous vector-borne transmission of Zika virus infection. The total number of countries and territories of the Region that had confirmed autochthonous cases by vector-borne transmission remained 48 and the number of countries that had reported sexually transmitted cases continued to be five (Table 4).

Table 4. Countries and territories with reported cases of Zika virus infection by autochthonous vector-borne transmission and by sexual transmission, through 12 January 2017

Type of transmission	Countries and territories
Autochthonous vector-borne transmission	Anguilla; Antigua and Barbuda; Argentina; Aruba; the Bahamas; Barbados; Belize; Bolivia (Plurinational State of); Bonaire, Sint Eustatius, and Saba; Brazil; the British Virgin Islands; the Cayman Islands; Colombia; Costa Rica; Cuba; Curaçao; Dominica; the Dominican Republic; Ecuador; El Salvador; French Guiana; Grenada; Guadeloupe; Guatemala; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico; Monserrat; Nicaragua; Panama; Paraguay; Peru; Puerto Rico; Saint Barthelemy; Saint Kitts and Nevis; Saint Lucia; Saint Martin; Saint Vincent and the Grenadines; Sint Maarten; Suriname; Trinidad and Tobago; Turks and Caicos Islands; the United States of America; the U.S. Virgin Islands; and Venezuela (Bolivarian Republic of).
Sexual transmission	Argentina, Canada, Chile, Peru, and the United States

North America⁵⁸

United States. As of 30 December 2016, no new cases of locally transmitted Zika virus infection had been reported.⁵⁹

Central America⁶⁰

Panama. A growing trend of suspected and confirmed cases was observed between EW 30 and EW 49 of 2016. The rest of the subregion showed a decline in the number of cases reported.⁶¹

⁵⁷ PAHO/WHO. Zika Epidemiological Update, 12 January 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2HO3Nw2>

⁵⁸ Canada, Mexico, and the United States of America.

⁵⁹ Source report available at: <https://www.cdc.gov/zika/reporting/2017-case-counts.html>

⁶⁰ Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

⁶¹ Source report available at: http://www.minsa.gob.pa/sites/default/files/publicacion-general/boletin_44_zk_sem51.pdf

Caribbean⁶²

In countries and territories of the Caribbean the number of cases maintained a downward trend.

South America⁶³

Except for Peru, the number of cases in the countries of this subregion continued to decline.

Peru. Between EW 40 and EW 50 of 2016, there was an increase in the number of suspected and confirmed cases, particularly, in the four districts of the city of Iquitos.⁶⁴

Congenital syndrome associated with Zika virus infection

As of 12 January 2017, 22 countries and territories of the Americas had reported confirmed cases of congenital syndrome associated with Zika virus infection. Since December 2016, no new countries or territories had reported cases of that syndrome for the first time. In the two weeks prior to this update, Brazil, Colombia, and the United States had updated the number of cases congenital syndrome associated with Zika virus infection.

Guillain-Barré Syndrome (GBS) and other neurological manifestations

Since December 2016, no new country or territory reported cases of Guillain-Barré Syndrome (GBS) associated with Zika virus infection.

26 January 2017⁶⁵

No new countries or territories confirmed autochthonous vector-borne transmission of Zika virus; therefore, the number of countries reporting vector-borne transmission remained 48. In addition, the number of countries that reported sexually transmitted cases remained 5.

North America

Mexico. Between EW 39 and EW 52 of 2016, the number of cases showed a declining trend.

United States. During EW 2 of 2017, the Florida Department of Health confirmed a new case of local transmission in a resident of Miami-Dade County, Florida state.⁶⁶ In addition, the state of Texas continued to record isolated cases.⁶⁷

Central America

The situation in the countries of this subregion remained the same with the exception of the following two countries.

Belize. There was an increase in cases reported between EW 49 and EW 51 of 2016.

Panama. The trend of suspected and confirmed cases increased between EW 30 and EW 50.⁶⁸

⁶² Anguilla, Antigua and Barbuda, Aruba, the Bahamas, Barbados, Bonaire, Saint Eustatius and Saba, the British Virgin Islands, Curacao, the Cayman Islands, Cuba, Dominica, the Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Puerto Rico, Saint Barthélemy, Saint Lucia, Saint Martin, Sint Maarten, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, and the U.S. Virgin Islands.

⁶³ Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, and Venezuela.

⁶⁴ Source report available at: <http://www.dge.gob.pe/portal/docs/vigilancia/boletines/2016/51.pdf>

⁶⁵ PAHO/WHO. Zika Epidemiological Update, 26 January 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2kqMe9b>

⁶⁶ Source report available at: <http://www.floridahealth.gov/newsroom/2017/01/011217-zika-update.html>

⁶⁷ Source report available at: <http://www.dshs.texas.gov/>

⁶⁸ Source report available at: http://www.minsa.gob.pa/sites/default/files/publicacion-general/boletin_1_y_2_zk_sem1_y_2.pdf

Caribbean

Although all countries and territories continued to report cases, the trend remained stable, with a weekly average of 598 new suspected and confirmed cases in the four weeks prior to 26 January 2017.

South America

Most countries and territories of this subregion continued to report cases; however, the trend remained stable. The weekly average of new suspected and confirmed cases was 5,439 for the four weeks prior to this report; of those cases, 5,273 were reported in Brazil.

Bolivia. Between EW 47 of 2016 and EW 2 of 2017, there was an increase in suspected and confirmed cases reported.

Paraguay. The trend of suspected cases increased between EW 42 and EW 50 of 2016.

Peru. An increase in reported cases was recorded during EW 1 of 2017, related to an outbreak in the department of Loreto.⁶⁹

Congenital syndrome associated with Zika virus infection

As of 26 January 2017, 22 countries and territories of the Americas had reported confirmed cases of congenital syndrome associated with Zika virus infection. Since December 2016, no new country or territory confirmed cases of congenital syndrome associated with Zika virus infection. In the two preceding weeks, Colombia, Puerto Rico, Suriname, and the United States, updated their number of cases of congenital syndrome.

GBS and other neurological manifestations

The situation remained unchanged.

9 February 2017⁷⁰

Note: As of this date, PAHO/WHO Epidemiological Updates on Zika were published monthly.

As of EW 44 of 2016, no new country or territory of the Americas confirmed autochthonous vector-borne transmission of Zika virus. Also, no new countries or territories reported sexually transmitted cases.

North America

Mexico. The number of reported cases showed a downward trend as of EW 39 of 2016; on average, nine cases were confirmed per week in the last four weeks.

United States. The Department of Health of the State of Florida continued to report isolated locally transmitted cases.⁷¹

Central America

The number of reported cases overall in Central America remained consistent in the last four weeks, with a weekly average of 369 new cases; of those, 317 were suspected and 52 confirmed.

⁶⁹ Source report available at: http://www.dge.gob.pe/portal/index.php?option=com_content&view=article&id=14&Itemid=121

⁷⁰ PAHO/WHO. Zika Epidemiological Update, 26 January 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2qKIL9t>

⁷¹ Source report available at: <http://www.floridahealth.gov/newsroom/2017/01/012717-zika-update.html>

Panama. A growing trend of suspected and confirmed cases persisted in the period between EW 30 of 2016 and EW 1 of 2017.⁷²

Caribbean

Montserrat. There was an upward trend in suspected and confirmed cases between EW 49 and EW 51 of 2016.

Although the other countries and territories of the Caribbean continued to report cases, the trend was stable, with a weekly average of 651 new cases (164 suspected and 487 confirmed) in the last four weeks.

South America

The number of cases was stable, with a weekly average of 6,601 suspected and confirmed cases in the last four weeks. Of those cases, 6,164 were reported in Brazil.

Paraguay. A rising trend in the number of suspected cases was observed between EW 42 of 2016 and EW 3 of 2017.

Peru. The number of reported cases increased between EW 1 and EW 3 of 2017; this was related to an outbreak in the department of Loreto.

Venezuela. The number of reported cases increased between EW 1 and EW 4 of 2017.

Congenital syndrome associated with Zika virus infection

As of 9 February 2017, 23 countries and territories of the Americas had reported confirmed cases of congenital syndrome associated with Zika virus infection. In EW 5 of 2017, Mexico, for the first time, reported a confirmed case of congenital syndrome associated with Zika virus infection. In the two weeks before 9 February 2017, health authorities of Argentina, Colombia, the Dominican Republic, Guadeloupe, Guatemala, Martinique, and the United States updated the number of cases of congenital syndrome associated with Zika virus infection.

GBS and other neurological manifestations

The situation remained unchanged.

10 March 2017⁷³

The number of countries and territories that confirmed autochthonous cases of vector-borne transmission of Zika virus infection remained the same as in previous periods. Also, no new countries or territories reported sexually transmitted cases.

North America

Mexico. New cases were still being reported, however the trend continued to decline as of EW 40 of 2016.

United States. The Florida Department of Health continued to report isolated locally transmitted cases.⁷⁴

⁷² Source report available at: http://www.minsa.gob.pa/sites/default/files/publicacion-general/boletin_1_y_2_zk_sem1_y_2.pdf

⁷³ PAHO/WHO. Zika Epidemiological Update, 10 March 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2F20Ch5>

⁷⁴ Source report available at: <http://www.floridahealth.gov/newsroom/2017/03/030217-zika-update.html>

Central America

The number of reported cases continued its downward trend. Between EW 6 and EW 9 of 2017, the average weekly number of new cases was 335 (275 suspected and 60 confirmed).

Costa Rica. A slight increase in suspected and confirmed cases was notified in EW 5 of 2017.

Panama. There was a growing trend in suspected and confirmed cases between EW 30 of 2016 and EW 1 of 2017. Although the number of cases in EW 2 of 2017 was lower, the number of new suspected and confirmed cases reported was, on average, 229 per week for the last four weeks.

Caribbean

Aruba. The number of suspected and confirmed cases increased between EW 29 of 2016 and EW 4 of 2017. In the last four weeks, a weekly average of 53 suspected and confirmed cases was reported.

Curaçao. The number of suspected and confirmed cases increased between EW 31 and EW 47 of 2016.

Guadeloupe and Martinique. The circulation of the virus remained low, with few isolated cases confirmed between EW 1 and EW 5 of 2017.

South America

With the exception of the following listed countries, the number of reported cases remained stable in the last four weeks.

Argentina. In EW 8 of 2017, for the first time, two autochthonous cases were reported, one in the province of Salta and the other in the province of Chaco. The latter case had travel history to the province of Formosa during the probable period of infection. In 2016, there were autochthonous cases confirmed in the provinces of Cordoba and Tucuman.⁷⁵

Paraguay. The number of suspected cases increased between EW 42 of 2016 and EW 5 of 2017.

Peru. In 2017, cases in new districts of the departments of Loreto, San Martin, and Ucayali were reported.

Trends: Central America, South America, and the Caribbean

Figure 21, below, illustrates the trend of suspected and confirmed Zika virus infection cases in the Caribbean, Central America, and South America. In EW 7 of 2016, the epidemiological curve for the three subregions began a downward trend in Central and South America. In the Caribbean, however it peaked in EW 23 of 2016. As of EW 40 of 2016, the trend remained stable in the three subregions.

Congenital syndrome associated with Zika virus infection

As of 10 March 2017, Saint Martin was added to the territories reporting confirmed cases of congenital syndrome associated with Zika virus infection. Twenty-four countries and territories of the Americas had reported confirmed cases of the syndrome. In the preceding four weeks, health authorities of Argentina, Brazil, Colombia, the Dominican Republic, French Guiana, Guadeloupe, Guatemala, Martinique, Puerto Rico, Trinidad and Tobago, and the United States updated the reported number of cases of congenital syndrome associated with Zika virus infection.

⁷⁵ Source report available at: http://www.msal.gov.ar/images/stories/boletines/boletin_integrado_vigilancia_N349-SE8.pdf

GBS and other neurological manifestations

In EW 7 of 2017, Curaçao and Trinidad and Tobago reported cases of GBS associated with Zika virus infection for the first time.

Below is the list of countries that reported increases in the number of cases of GBS or laboratory-confirmed Zika virus infection in at least one GBS case (Table 5).

Table 5. Countries and territories of the Americas that have reported cases of Guillain-Barré syndrome (GBS) associated with Zika virus circulation

Increase in the number of cases of GBS and laboratory confirmation of Zika virus, in at least one case of GBS	Laboratory confirmation of Zika virus infection in at least one case of GBS	Increase in the number of cases of GBS, without Zika virus laboratory-confirmed cases
Brazil	Bolivia	Paraguay
Colombia	Costa Rica	Saint Vincent and the Grenadines
Curaçao	Grenada	
Dominican Republic	Haiti	
El Salvador	Mexico	
French Guiana	Panama	
Guadeloupe	Saint Martin	
Guatemala		
Honduras		
Jamaica		
Martinique		
Puerto Rico		
Suriname		
Trinidad and Tobago		
Venezuela		

27 April 2017⁷⁶

As of EW 44 of 2016, no new countries or territories confirmed cases of autochthonous vector-borne transmission of Zika virus. Also, no new countries or territories reported sexually transmitted cases.

North America

Mexico. As of EW 40 of 2016, the number of confirmed cases began to decline. Zika virus circulation had not been detected in new states of the country.

United States. The Florida Department of Health reported that no areas with active transmission of Zika remained in Florida State, although locally transmitted isolated cases were still being reported.⁷⁷ In addition, the Texas Department of State Health Services had not reported cases of local transmission during 2017.⁷⁸

⁷⁶ PAHO/WHO. Zika Epidemiological Update, 27 April 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2Jcjo7>

⁷⁷ Source report available at: <http://www.floridahealth.gov/newsroom/2017/03/032017-zika-update.html>

⁷⁸ Source report available at: <http://www.dshs.texas.gov/news/releases/2017/20170407.aspx>

Central America

A downward trend in the number of cases in the subregion continued, with the exception of Guatemala. Between EW 1 and EW 10 of 2017, an average of 180 new suspected and confirmed cases was reported weekly.

Guatemala. A light increase in the number of suspected and confirmed cases was observed between EW 1 and EW 9 of 2017. The same situation was observed in regard to dengue in that same period in the country.

Caribbean

Aruba. In EW 29 of 2016 there was an increase in the number of suspected and confirmed cases.

In other countries and territories of the Caribbean, the trend was declining, and 545 was the average number of new cases reported between the EW 1 and EW 10 of 2017.

South America

Following a downward trend in reported cases from EW 7 of 2016, starting in EW 1 of 2017, that number increased in the subregion, mainly due to the number of cases reported in **Bolivia**, **Brazil**, **Ecuador**, and **Peru**. Between EW 1 and EW 10 of 2017, an average of 1,247 new suspected and confirmed cases were reported weekly in this subregion.

Argentina. Between EW 8 and EW 16 of 2017, three new provinces (Chaco, Formosa and Salta) reported autochthonous circulation of the Zika virus, bringing the total to five provinces.⁷⁹

Bolivia. There was an increase in the number of cases from early 2017, with 280 cases confirmed in the first 12 weeks of that year in the department of Beni.

Brazil. Between EW 1 and EW 9 of 2017, the number of suspected and confirmed cases of Zika increased slightly, as did the number of chikungunya cases in that same period.⁸⁰

Ecuador. Starting in EW 5 of 2017, the number of cases increased. Of the confirmed cases in the first 15 weeks of 2017, 68 % (401) were in the province of Guayas.⁸¹

Peru. The number of reported cases increased, mainly due to an ongoing outbreak in the department of Loreto. In addition, starting in EW 9 of 2017, an outbreak occurred in the province of Chincha, department of Ica.⁸²

Congenital syndrome associated with Zika virus infection

As of 27 April 2017, 26 countries and territories of the Region of the Americas had reported confirmed cases of congenital syndrome associated with Zika virus infection. In EW 15 and EW 17 of 2017, Barbados and Ecuador confirmed cases of congenital syndrome associated with Zika virus infection for the first time; and in the eight preceding weeks (EW 10 to EW 17), Brazil, Colombia, Costa Rica, Ecuador, Grenada, Guadeloupe, Guatemala, Martinique, Mexico, Puerto Rico, and the United States updated their previously reported numbers.

⁷⁹ Source reports available at: http://www.msal.gov.ar/images/stories/boletines/boletin_integrado_vigilancia_N356-SE16.pdf and <http://www.msal.gov.ar/images/stories/boletines/Boletin-Integrado-De-Vigilancia-N343-SE2.pdf>

⁸⁰ Source report available at: <http://portalarquivos.saude.gov.br/images/pdf/2017/abril/06/2017-010-Monitoramento-dos-casos-de-dengue--febre-de-chikungunya-e-febre-pelo-virus-Zika-ate-a-Semana-Epidemiol--gica-12--2017.pdf>

⁸¹ Source report available at: http://www.salud.gov.ec/zika/gaceta-zika_se15/

⁸² Source report available at: <http://www.dge.gov.pe/portal/docs/vigilancia/boletines/2017/14.pdf>

GBS and other neurological manifestations

In EW 17 of 2017, Barbados reported for the first time five cases of GBS associated with Zika virus infection.

25 May 2017⁸³

No new countries or territories confirmed autochthonous cases of vector-borne Zika virus transmission in the Region of the Americas. Also, no new countries or territories reported sexually transmitted cases.

North America

Mexico. Confirmed cases continued to be reported, although in smaller numbers starting in EW 40 of 2016. No new states reported circulation of the virus.

United States. The epidemiological situation in the states of Florida and Texas remained the same.

Central America

With the exception of Belize, the number of cases reported in the subregion continued to decrease. Between EW 10 and EW 14 of 2017, the weekly average number of new suspected and confirmed cases was 71 for the subregion.

Belize. An increase in the number of suspected and confirmed cases was observed between EW 49 of 2016 and EW 7 of 2017. Most confirmed cases occurred in the Corozal district.

Caribbean

Turks and Caicos Islands. The number of suspected cases increased between EW 4 and EW 8 of 2017.

In other countries and territories of the subregion, the number of reported cases continued its downward trend. For EW 10 to EW 14 of 2017, the weekly average number of new cases reported was of 330, including both suspected and confirmed cases.

South America

Starting in EW 1 of 2017, a growing trend in the number of suspected and confirmed cases was observed. That increase was, mainly due to cases reported in Argentina, Bolivia, Brazil, Ecuador, and Peru. Between EW 10 and EW 14 of 2017, on average, 1,246 new suspected and confirmed weekly cases were reported in the subregion.

Argentina. The number of suspected and confirmed cases increased between EW 1 and EW 16 of 2017; the increase was related to outbreaks in the provinces of Chaco, Formosa, and Salta. In Chaco and Salta, the date of onset of symptoms of the last confirmed cases was in EW 16 of 2017.⁸⁴

Brazil. There was a slight increase in the number of reported cases between EW 1 and EW 9 of 2017, followed by a decrease that lasted through EW 15 of the same year, similar to the decline in reported cases of chikungunya during the same period.⁸⁵

⁸³ PAHO/WHO. Zika Epidemiological Update, 25 May 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2K058QX>

⁸⁴ Source reports available at: http://www.msal.gob.ar/images/stories/boletines/boletin_integrado_vigilancia_N356-SE16.pdf and http://www.msal.gob.ar/images/stories/boletines/boletin_integrado_vigilancia_N359-SE19.pdf

⁸⁵ Source report available at: <http://portalarquivos.saude.gov.br/images/pdf/2017/maio/05/Monitoramento-dos-casos-de-dengue-febre-de-chikungunya-e-febre-pelo-virus-Zika-ate-a-Semana-Epidemiologica.pdf>

Ecuador. As of EW 5 of 2017, there was an increase in the number of suspected and confirmed cases, reaching its peak during EW 16 of 2017. Of the number of cases confirmed in the first 17 weeks of 2017, 65% (448) were from the province of Guayas.⁸⁶

Peru. The increase in the number of cases was due, mainly to an outbreak in the department of Loreto. Starting in EW 10 of 2017, there was also an increase in the number of suspected and confirmed cases due to the outbreak in the province of Chincha, department of Ica. As of 25 May 2017, the maximum number of cases had been recorded in EW 14 of 2017.⁸⁷

Congenital syndrome associated with Zika virus infection

No additional country or territory reported confirmed cases of congenital syndrome associated with Zika virus infection during this reporting period. Between EW 18 and EW 21 of 2017, Brazil, Colombia, the Dominican Republic, Ecuador, Honduras, Panama, Puerto Rico, and the United States updated their number of cases of congenital syndrome associated with Zika virus infection.

GBS and other neurological manifestations

No country or territory confirmed cases of GBS associated with Zika virus infection for the first time.

26 July 2017⁸⁸

No new countries or territories confirmed autochthonous cases of vector-borne Zika virus transmission in the Region of the Americas. Also, no new countries or territories reported sexually transmitted cases.

North America

Mexico. Reporting remained unchanged from the previous period. In EW 27 of 2017, Zika virus circulation was confirmed in the state of Mexico.

United States. The epidemiological situation in the states of Florida and Texas remained the same.

Central America

The number of reported cases in the subregion, with the exception of Costa Rica, remained stable with a weekly average of 70 new suspected and confirmed cases reported between EW 15 and EW 25 of 2017.

Costa Rica. There was an increase in the number of suspected and confirmed cases between EW 16 and EW 26 of 2017.

Caribbean

In this subregion, sporadic cases continued to be reported, with a weekly average of 291 new suspected and confirmed cases between EW 15 and EW 25 of 2017.

Puerto Rico. The number of cases decreased in the preceding eight weeks.

⁸⁶ Source report available at: http://www.salud.gob.ec/wp-content/uploads/2015/12/GACETA-ZIKA_SE17.pdf

⁸⁷ Source report available at: <http://www.dge.gob.pe/portal/docs/vigilancia/boletines/2017/17.pdf>

⁸⁸ PAHO/WHO. Zika Epidemiological Update, 26 July 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2vpXCeM>

South America

From EW 1 through EW 14 of 2017, there was a growing trend in the number of suspected and confirmed cases reported in this subregion, mainly due to increases reported in Argentina, Bolivia, Brazil, Ecuador, and Peru (Figure 32). Between EW 15 and EW 25 of 2017, on average, 863 new suspected and confirmed cases were recorded weekly in the subregion.

Argentina. The number of suspected and confirmed cases increased between EW 1 and EW 16 of 2017, due to the outbreak in the provinces of Chaco, Formosa and Salta. In Chaco and Salta, the date of onset of symptoms of the last confirmed cases reported was during EW 16 and EW 20 of 2017, respectively.⁸⁹

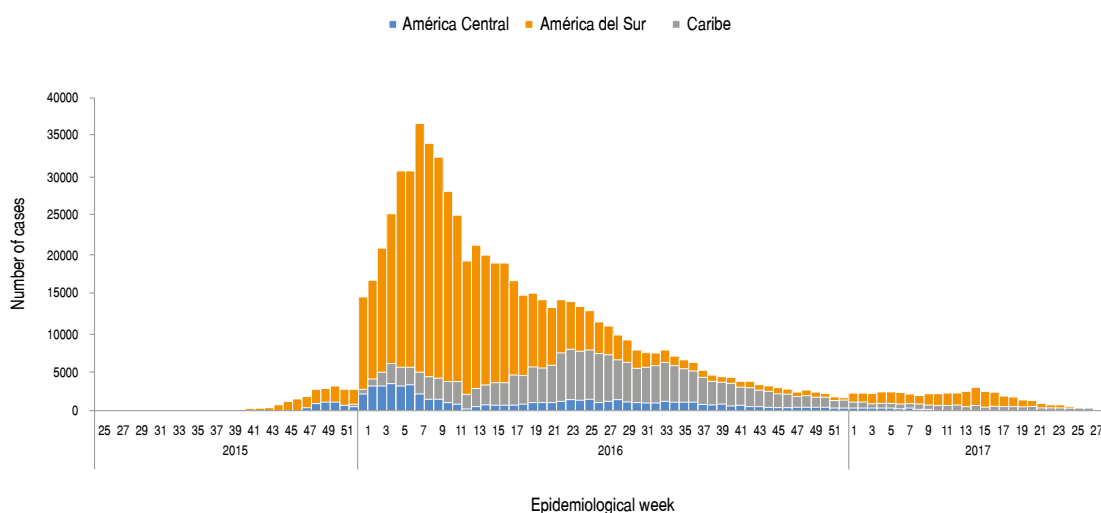
Bolivia. Starting in EW 1 of 2017, an increase in suspected and confirmed cases was observed, peaking during EW 10 of 2017, similar to the curve for the dengue cases. Of the confirmed Zika cases in the first 28 weeks of 2017, 59% (348) occurred in the department of Beni and 28% (169) occurred in the department of Santa Cruz.

Brazil. The number of reported cases of Zika virus infection increased slightly between EW 1 and EW 6 of 2017; subsequently, through EW 22, that number declined, as did the number of cases of chikungunya in the same period

Ecuador. Starting in EW 5 of 2017, there was an increase in the number of suspected and confirmed cases, which reached its maximum in EW 16 of 2017. Of the laboratory-confirmed cases in the first 27 weeks of 2017, 60% (770) came from the province of Guayas and 16% (211) came from the province of and Manabi.⁹⁰

Peru. Starting in EW 10 of 2017, suspected and confirmed cases began to increase reaching their peak in EW 14 of 2017. Outbreaks were reported in the departments of Cajamarca, Ica, La Libertad, Lima, Piura, and Tumbes, where dengue and chikungunya outbreaks were also reported (Piura) during 2017.⁹¹

Figure 31. Suspected and confirmed cases of Zika virus infection, by EW and subregion, Region of the Americas, 2015 to 2017 (to EW 27)



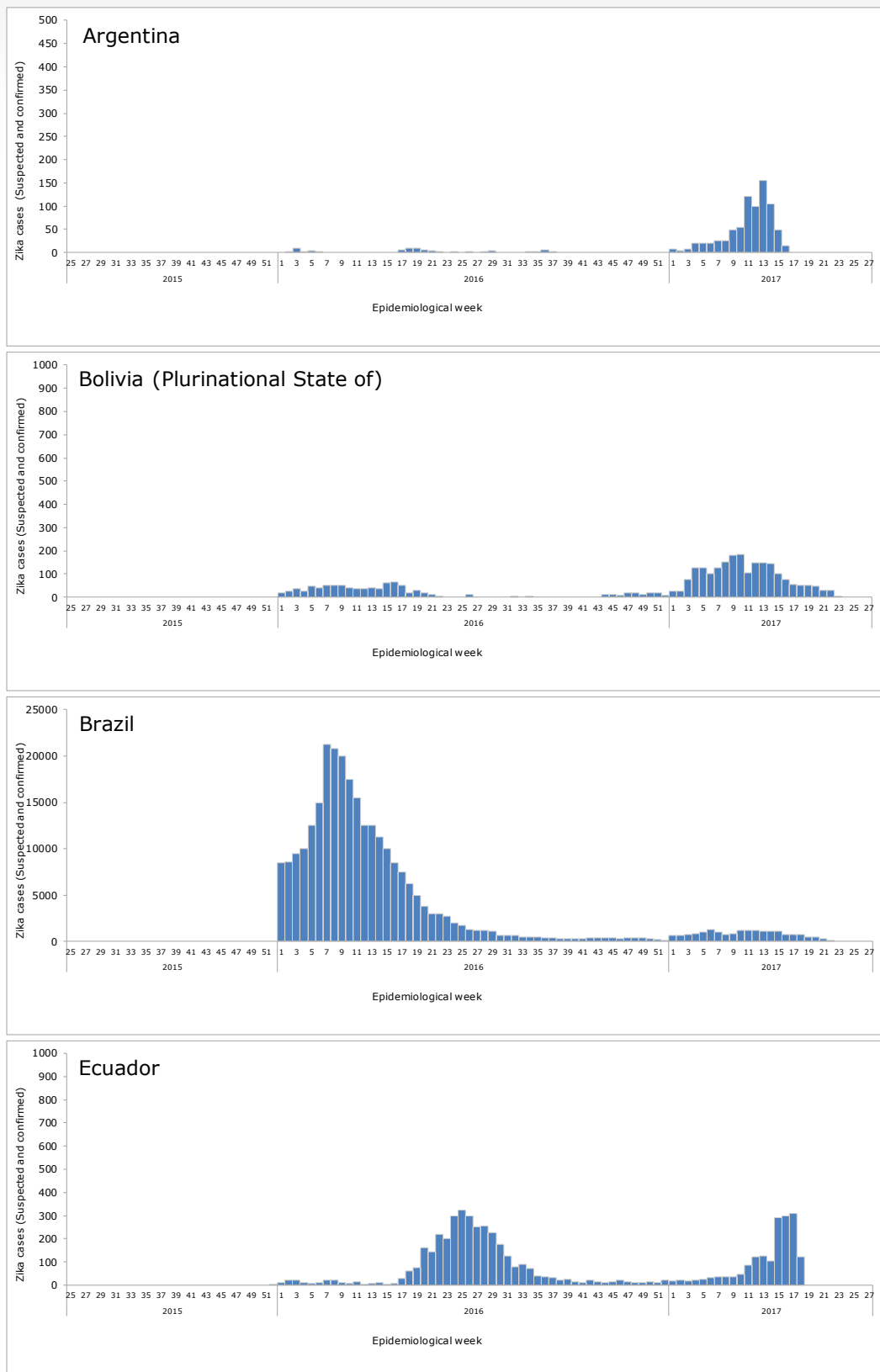
Source: Data provided by countries and territories from the Americas

⁸⁹ Source reports available at: http://www.msal.gov.ar/images/stories/boletines/boletin_integrado_vigilancia_N356-SE16.pdf and http://www.msal.gov.ar/images/stories/boletines/boletin_integrado_Vigilancia_N368-SE28.pdf

⁹⁰ Source report available at: http://www.salud.gov.ec/wp-content/uploads/2015/12/vvGACETA-ZIKA_SE27.pdf

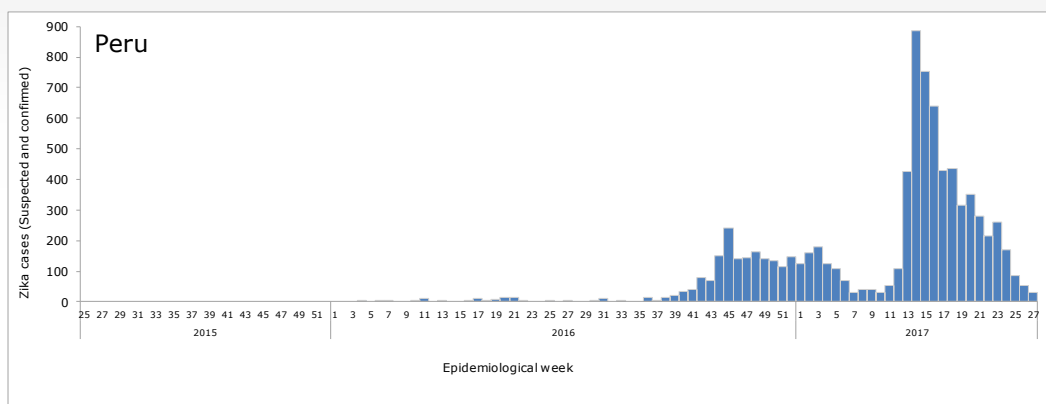
⁹¹ Source report available at: <http://www.dge.gov.pe/portal/docs/vigilancia/boletines/2017/26.pdf>

Figure 32. Suspected and confirmed cases of Zika virus infection, by EW. Argentina, Bolivia, Brazil, Ecuador, and Peru, EW 25 of 2015 to EW 27 of 2017



Source: Data provided by the Ministries of Health of Argentina, Bolivia, Brazil, Ecuador, and Peru and reproduced by PAHO/WHO.

Figure 32. Suspected and confirmed cases of Zika virus infection, by EW. Argentina, Bolivia, Brazil, Ecuador, and Peru, EW 25 of 2015 to EW 27 of 2017



Congenital syndrome associated with Zika virus infection

Since October 2015, 26 countries and territories of the Americas have reported confirmed cases of congenital syndrome associated with Zika virus infection. These countries remained the same following the most recent report. Between EW 22 and EW 29 of 2017, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Guadeloupe, Guatemala, Martinique, Mexico, Panama, Puerto Rico, Saint Martin, and the United States updated the number of reported cases of congenital syndrome associated with Zika virus infection. In Saint Martin, the case was a fetus with cerebral malformation, whose mother had Zika virus infection.

GBS and other neurological manifestations

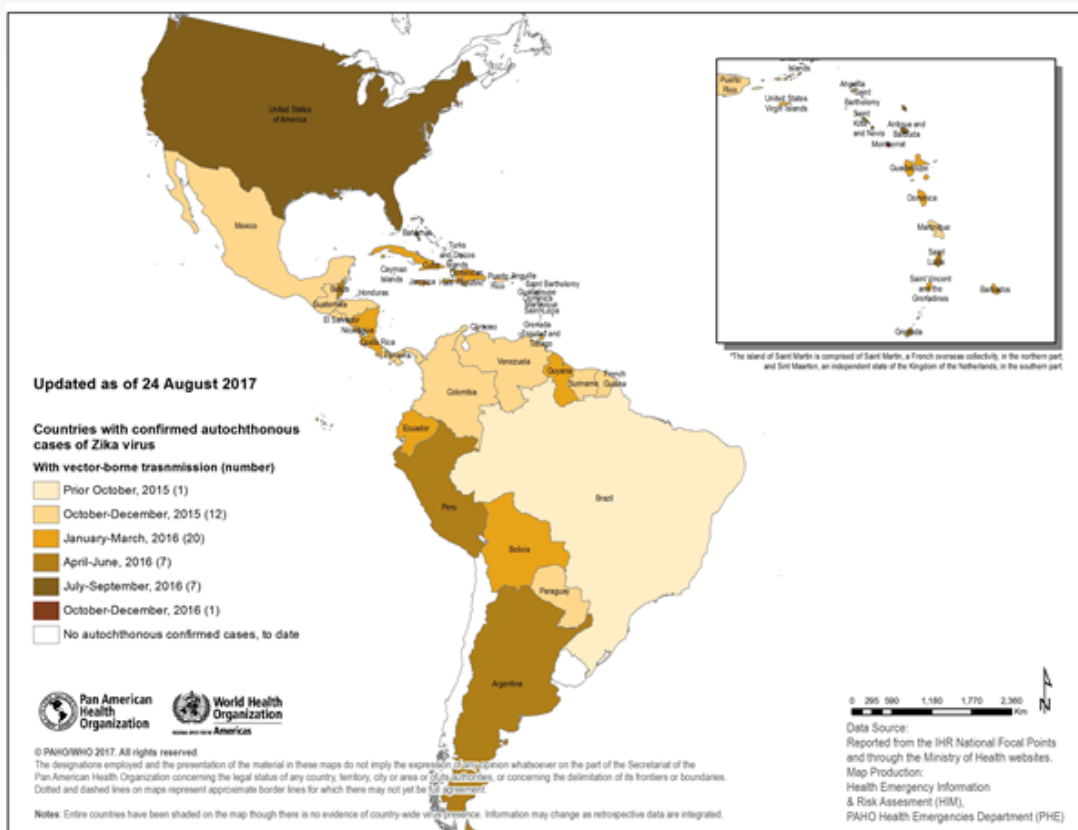
Between 25 May and 26 July of 2017, Ecuador and the British Virgin Islands reported, for the first time, confirmed cases of GBS or other neurological syndromes associated with Zika virus infection.

25 August 2017⁹²

Since EW 44 of 2016, no new country or territory of the Americas confirmed autochthonous vector-borne transmission of Zika virus. The number of countries and territories with confirmed autochthonous vector-borne transmission cases remained at 48 (Figure 33). Also, no new countries or territories reported sexually transmitted cases.

⁹² Pan American Health Organization / World Health Organization. Zika Epidemiological Update, 25 August 2017. Washington, D.C.: PAHO/WHO; 2017. Available at: <https://bit.ly/2wNXyLv>

Figure 33. Countries and territories of the Americas with confirmed cases of autochthonous Zika virus infection (vector-borne transmission) 2015 to 24 August 2017



North America

Mexico. Between EW 16 and EW 27 of 2017, there was an increase in the number of confirmed cases (Figure 34), as well as of the number of cases of dengue.⁹³ Of the total number of cases confirmed in the first 32 weeks of 2017, 51% were from the states of Nayarit (171 cases), Tamaulipas (146 cases), and San Luis Potosi (123 cases). The number of cases confirmed in those states was higher than the number reported in 2015-2016.⁹⁴

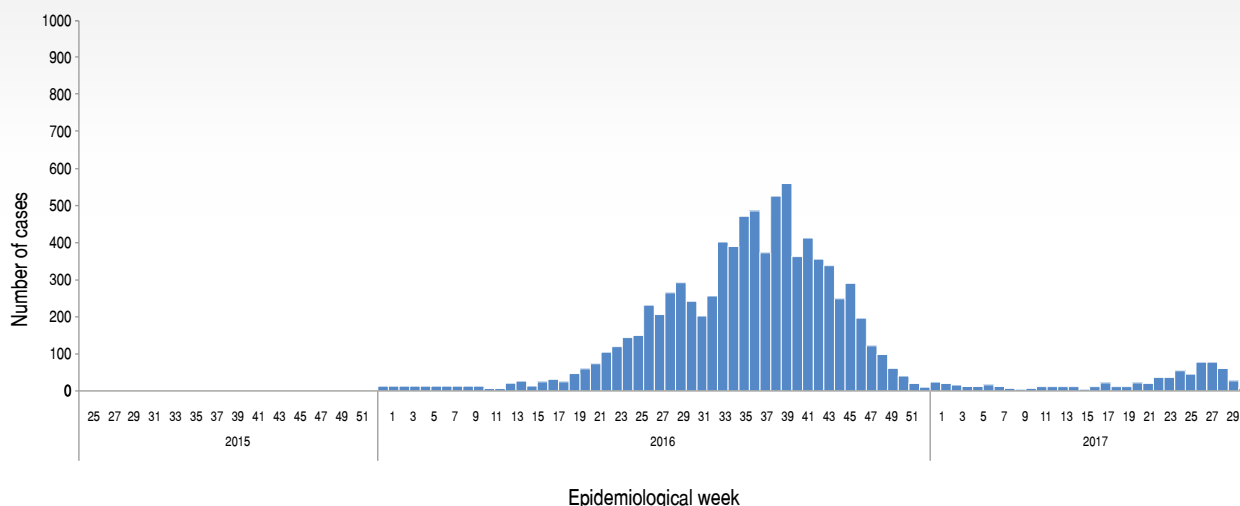
United States. No changes were reported in the epidemiological situation in the state of Florida. In EW 30 of 2017, the Texas Department of State Health Services and the Hidalgo County Health and Human Services reported a probable case of local vector-borne transmission during 2017.⁹⁵

⁹³ Source report available at: https://www.gob.mx/cms/uploads/attachment/file/249615/Pano_dengue_sem_32_2017.pdf

⁹⁴ Source report available at: <https://www.gob.mx/cms/uploads/attachment/file/250310/sem32.pdf>

⁹⁵ Source reports available at: <http://www.floridahealth.gov/diseases-and-conditions/zika-virus/index.html> and <http://www.dshs.texas.gov/news/releases/2017/20170726.aspx>

Figure 34. Number of confirmed Zika cases, Mexico, 2015 to EW 30 of 2017

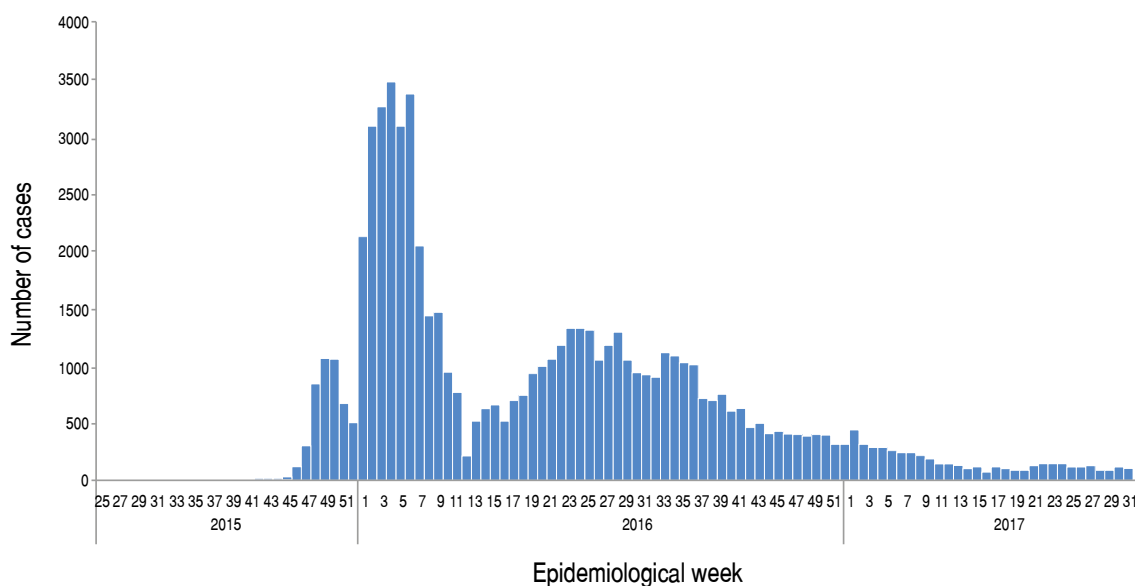


Source: Data provided by the Mexico Secretariat of Health and reproduced by PAHO/WHO.

Central America

Between EW 20 and EW 30 of 2017, a small increase was observed in the number of suspected and confirmed cases in the subregion, mainly due to cases recorded in **Belize** and **Costa Rica**. The average weekly number of cases between EW 21 and EW 30 of 2017 was 117, including suspected and confirmed cases (Figure 35).

Figure 35. Suspected and confirmed Zika cases, Central America. 2015 to EW 32 of 2017



Source: Data provided by the Mexico Secretariat of Health and reproduced by PAHO/WHO.⁹⁶

⁹⁶ Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Panama

Caribbean

In the countries and territories of this subregion, sporadic cases continued to be reported, with a weekly average of 252 new suspected and confirmed cases between EW 21 and EW 30 of 2017.

Puerto Rico. The number of cases declined in the preceding 10 weeks.

South America

As of EW 14 of 2017, there was a decline in the number of suspected and confirmed cases, with the exception of Ecuador. Between EW 21 and EW 30 of 2017, on average, 293 suspected and confirmed cases were recorded weekly in the subregion.

Ecuador. An increase was reported between EW 4 and EW 20 of 2017.

Congenital syndrome associated with Zika virus infection

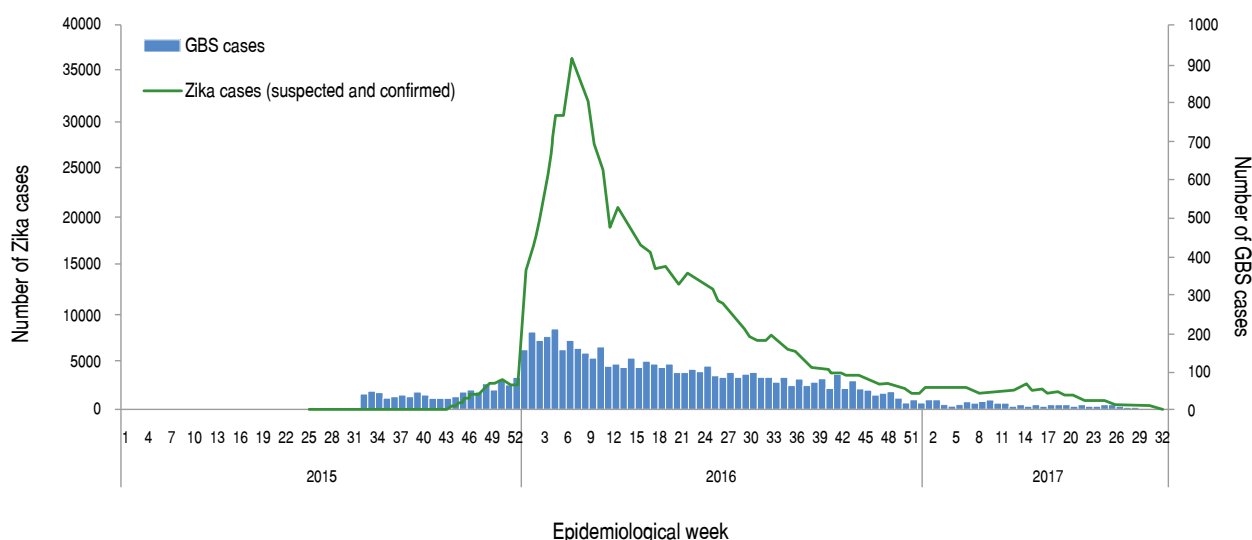
From 26 July to 25 August of 2017, Guyana was added to the list of countries and territories with confirmed cases of congenital syndrome associated with Zika virus infection (three cases detected between September and December 2016); this brought the total **countries** and territories to 27.

GBS and other neurological manifestations

No additional country or territory confirmed cases of GBS associated with Zika virus infection for the first time.

Figure 36 illustrates the trends of the number of cases of Zika virus infection and associated cases of GBS based on the countries and territories for which information on the distribution of cases by EW was available at the time.

Figure 36. Confirmed and suspected Zika cases and associated GBS cases, Region of the Americas, 2015 to EW 32 of 2017



Source: Data provided by countries and territories of the Americas.

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