Progress Report

Chagas Disease Vector Control Project

Republic of Guatemala

2000 - 2002

JICA

Ministerio de Salud Pública
República de Guatemala

OPS/OMS

This document was prepared by Jun Nakagawa, JICA expert. This document was originally written as a part of Evaluation Report of JICA expert, and was submitted to the Ministry of Health of Guatemala and JICA in January 2003.

1. Summary of the Accomplishments of the Chagas Disease Vector Control Project

1.1. Introduction

Chagas disease is one of the most serious vector-born diseases in Guatemala. It is estimated that in Guatemala 4,000,000 people are at risk for Chagas disease, 730,000 people are currently infected, and 30,000 people are infected annually. Chagas disease is a parasitic infection that in its chronic stage produces irreversible organ damage. It is caused by a flagellate protozoan, *Trypanosoma cruzi*, which is transmitted to humans through the feces of blood-sucking triatomine bugs. There are two main domiciliated triatomine species in Guatemala: *Rhodnius prolixus* and *Triatoma dimidiata*. Through a national survey conducted as part of Japan International Cooperation Agency (JICA)'s technical cooperation between 1995-1998, it was shown that the populations in the departments in the eastern part of the country were at highest risk of Chagas disease transmission.

The Central American Initiative for the Control of Vectoral and Transfusional Transmission of *T. cruzi* (IPCA) was launched in 1997 through the Meeting for the Health Sector of Central America (RESSCA). The initiative set a goal for the interruption of Chagas disease transmission by the end of 2010 through the elimination of *R. prolixus*, reduction in the domestic infestation index of *T. dimidiata*, and elimination of the transmission of *T. cruzi* through blood transfusion.

Under this initiative, the Ministry of Health of Guatemala (MSPAS) and JICA initiated a vector control project directed at eliminating Chagas disease transmission in five departments (Zacapa, Chiquimula, Jutiapa, Santa Rosa, and Jalapa) in the eastern region of Guatemala in January 2000, in collaboration with the Pan American Health Organization (PAHO), the Medical Entomology Research and Training Unit/Guatemala, the Center for Disease Control of the United States and Center for Health Studies/University of Valle of Guatemala (UVG/CDC-MERTUG), and the University of San Carlos of Guatemala (USAC).

In order to achieve these objectives, activities such as vector surveys, residual spraying of insecticides, capacity building of vector control personnel, and health education were implemented. In 2002, the project was extended to four more departments: Alta Verapaz, Baja Verapaz, El Progreso, and El Quiche with a duration of three years. The project is administered under a decentralized health system (SIAS: Sistema de Integracion de Area de Salud), and each health area (Area de Salud) is responsible for the implementation. The ETV (Enfermedades Transmitidas por Vector) team of each health area executes the project.

At the central level, the National Vector Control Program is responsible for coordination and supervision of the project. JICA provides experts at the central level, and volunteers at the health area level to provide technical assistance in the implementation of the project.

2. Outcome of vector control activities

2.1. Vector survey

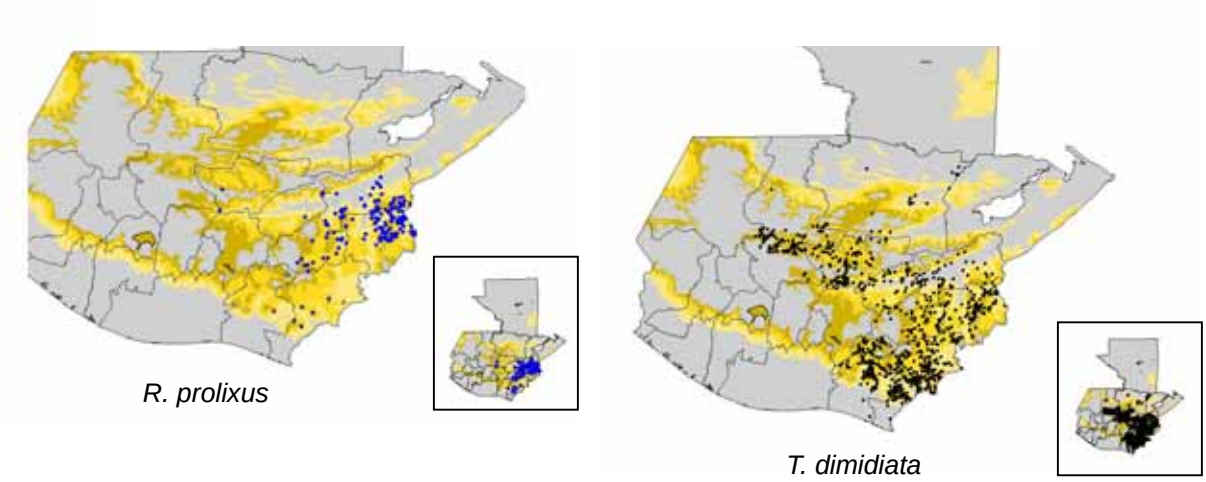
As a first step in the project, a vector survey was conducted in five health areas (Zacapa, Chiquimula, Jutiapa, Santa Rosa, Jalapa) from April to November 2000. A vector survey in four health areas (Alta Verapaz, Baja Verapaz, El Quiche, El Progreso) was implemented from August 2001 to November, 2002. The ETV team of each health area surveyed villages with the collaboration of UVG-MERTUG/CDC and USAC. A total of 64,347 houses in 3,044 villages were surveyed, and 203 villages were found to be infested by *R. prolixus* and/or *T. dimidiata*. The extent of coverage of the survey is shown in Table 1.

Table1. Coverage of the vector survey in 9 health areas

Health Area	No. of existing villages	No. of surveyed villages	Coverage (%)
Zacapa	508	224	44.0
Chiquimula	818	143	17.5
Jutiapa	769	569	74.0
Santa Rosa	650	205	31.5
Jalapa	333	272	81.6
El Progreso	324	205	63.3
Baja Verapaz	427	372	87.1
Alta Verapaz	1,183	713	60.3
El Quiche	657	341	51.9
Total	5,660	3,044	53.8

R. prolixus was found in 291 villages in seven health areas (Zacapa, Chiquimula, Jutiapa, Santa Rosa, El Progreso, Baja Verapaz, El Quiche), and the majority of the infested villages were located in Chiquimula as shown in figure 1. *T. dimidiata* was found in all the health areas in the project. Most of the infested villages are located in the areas between 400 and 1,600m above sea level.

Fig. 1: Distribution of *T. dimidiata* and *R. prolixus*.



R. prolixus

T. dimidiata

● : Villages infested with *R. prolixus* ● : Villages infested with *T. dimidiata*

■ : Altitudes between 400 and 1,600m

From the results of the vector survey, entomological indices were calculated to examine the level of infestation in each health area. Table 2 shows the infestation index of each health area.

Table 2. Infestation index of nine health areas of Guatemala

Health Area	No. of houses surveyed	Infestation index (%)	
		R. prolixus	*T. dimiidata*
Zacapa	1,403	1.8	1.6
Chiquimula	1,731	2.9	10.7
Jutiapa	3,985	0.0	18.3
Santa Rosa	3,277	0.0	18.4
Jalapa	1,141	5.5	18.8
Alta Verapaz	10,970	0.0	3.3
Baja Verapaz	7,250	0.0	8.2
El Progreso	2,451	0.0	6.9
El Quiche	32,139	0.0	9.1

2.2. Vector control activity

As a result of the survey, MSPAS and the health areas developed plans for the vector control activities through workshops, and residual spraying activities were started in

municipalities which had the highest infestation rates. Elimination of *R. prolixus* was the first priority of the activity, and all the houses in the villages infested with *R. prolixus* were targeted for two rounds of residual spraying. Villages infested with *T. dimidiata* were prioritized according to the infestation indices. Villages with infestation rates higher than five percent were targeted for the intervention. Houses constructed with mud walls or thatched roofs in the infested communities were also treated.

The vector control activity was initiated in August 2000, and a total of 91,026 houses in 852 villages were sprayed (Table 3). The number of people who directly benefited is approximately 455,000. MSPAS contracted sprayers for the project, and an average of eight houses were sprayed per day.

Table 3. Number of houses sprayed in five health areas

Health Area	No. of houses sprayed	
	1st spraying	2nd spraying
Zacapa	6,151	6,847
Chiquimula	21,554	0
Jutiapa	24,250	7,058
Santa Rosa	16,206	0
Jalapa	4,845	4115
TOTAL	**73,006**	**18,020**

Table 4. Number of villages sprayed

Health Area	*R. prolixus*		*T. dimidiata*	
	No. of infested villages	No. of villages sprayed	No. of infested villages	No. of villages sprayed
Zacapa	32	32*	44	44*
Chiquimula	221	218	No data	0
Jutiapa	10	10*	167	142
Santa Rosa	1	1*	240	238
Jalapa	27	27*	112	70
Total	**291**	**288**	**563**	**450**

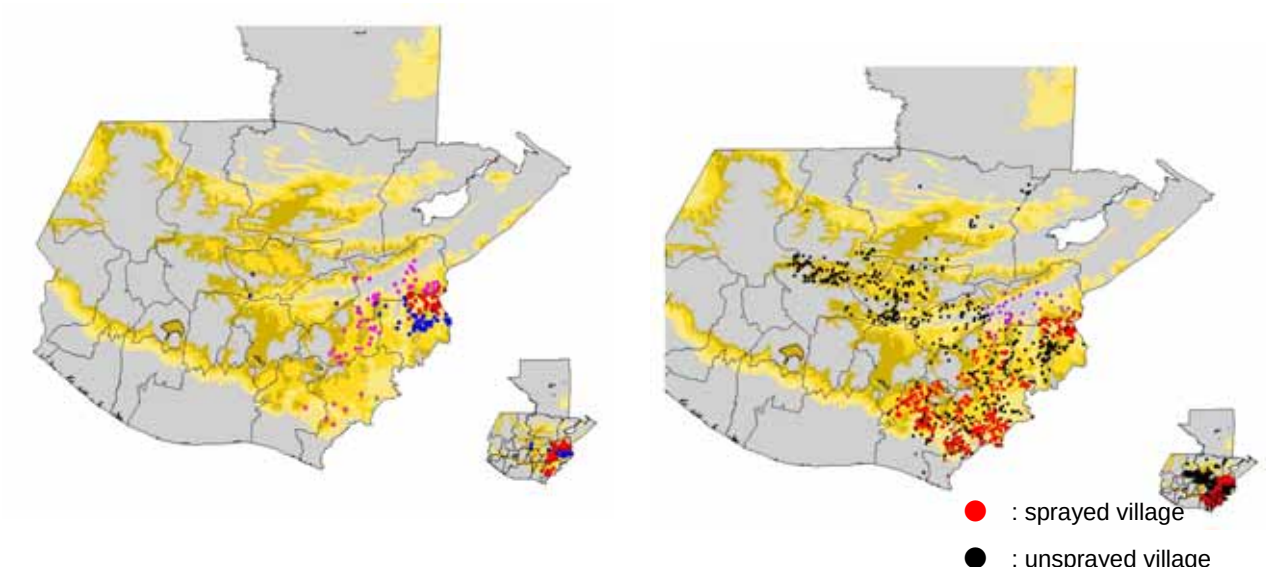
December 10, 2002

*: Two rounds of spraying were completed.

More than 98% of the villages infested with *R. prolixus* were treated with insecticides. In Zacapa, Jutiapa, Santa Rosa and Jalapa, two rounds of residual spraying were completed.

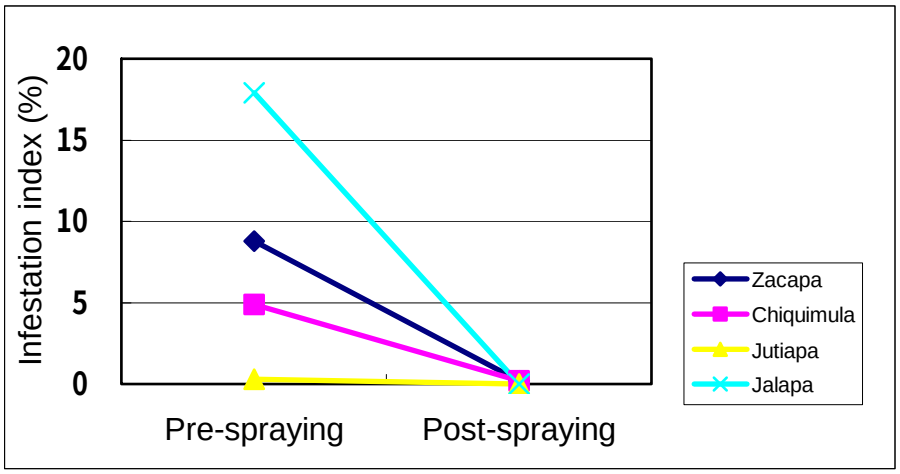
450 villages infested with *T. dimidiata* were sprayed, and a second round of spraying was completed in Zacapa. In Jutiapa and Santa Rosa, the second round of spraying is in progress (Table 4). Figure 2 shows the progress of the spraying activities at the village level.

Fig. 2: Map of sprayed villages



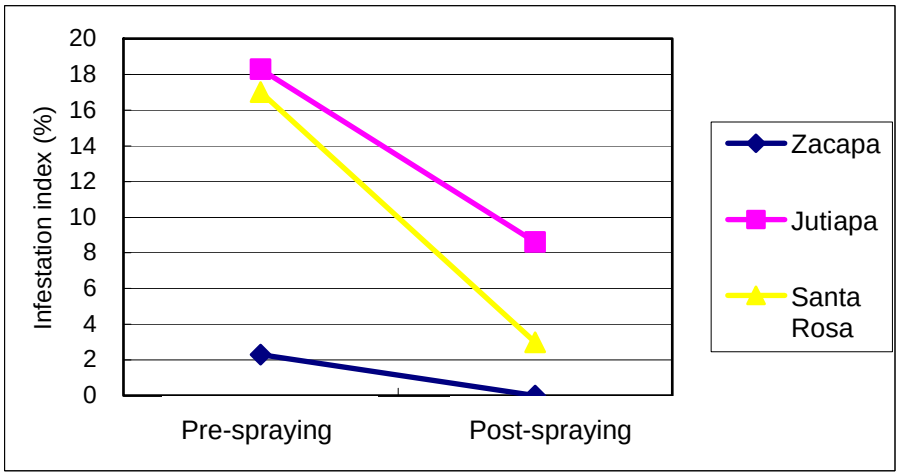
The vector control operation showed that elimination of *R. prolixus* is feasible in Guatemala. As Figure 3 shows, the infestation index of *R. prolixus* dropped significantly after the intervention. The overall infestation index dropped from 4.5% to 0.1%. In Jutiapa, Santa Rosa and Jalapa, the infestation index reached 0 % in 2002, which makes the elimination of *R. prolixus* feasible by 2005 for Jutiapa, Zacapa, and Jalapa, and by 2006 for Chiquimula, El Progreso, Baja Verapaz, and El Quiche. There is an urgent need to strengthen the vector control activity in Chiquimula. MSPAS has planned to hire additional sprayers for Chiquimula to complete the first round of spraying of all the infested villages. Residual spraying against *R. prolixus* in villages in El Quiche, El Progreso, and Baja Verapaz will start in 2003.

Fig. 3: Infestation index of *R. prolixus* pre- and post-spraying



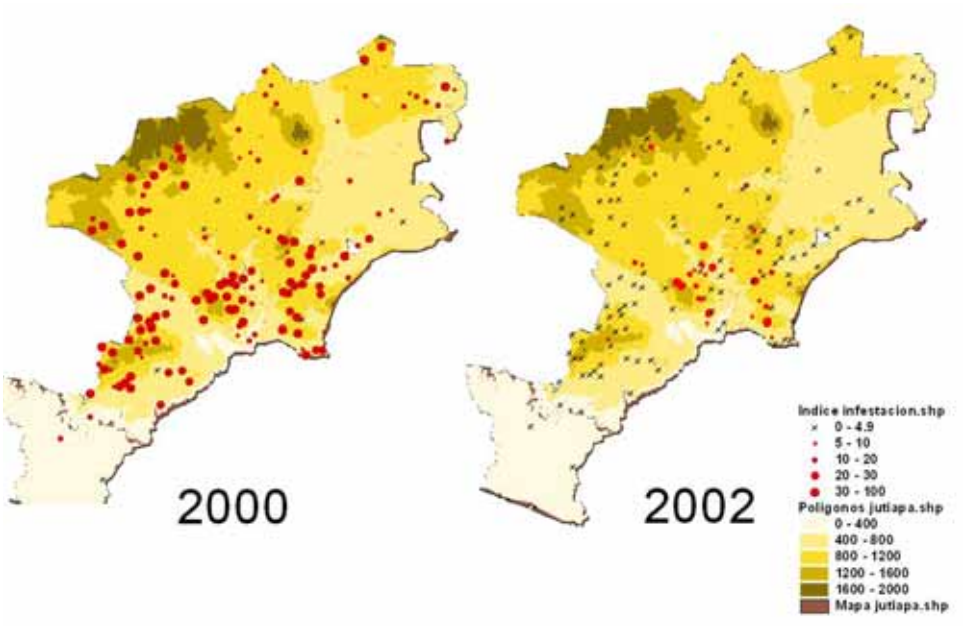
Vector control against *T. dimidiata* had also significant impact in reducing its domestic population. The infestation index dropped significantly in the villages sprayed in all five health areas. Figure 4 shows the reduction of the infestation index.

Fig. 4: Infestation index of *T. dimidiata* pre- and post-spraying



The project used the Geographic Information System (GIS) to visualize the impact of the vector control in Jutiapa. Figure 5 below show the decrease in infestation indices of *T. dimidiata* of the infested villages pre- and post-spraying.

Fig. Change of infestation indices of villages infested by *T. dimidiata*



2.4. Capacity building of project personnel

Training and capacity building activities were realized throughout the project. At the central level, project personnel were trained in project planning, monitoring, vector control, GIS, and tropical disease. At the health area level, ETV personnel received training in mapping, project planning, vector surveying, insecticide spraying, and data evaluation. Table 5 summarizes the capacity building activities.

TABLE 5. Capacity building at the central level (Chagas disease program coordinator and the chief of Medical Entomological section)

Area of capacity building	Chagas Coordinator	Chief, entomological section
Vector biology	On the Job Training (OJT)	OJT, by JICA experts
Vector survey	--------	OJT, by JICA experts
Vector control	OJT	OJT, by JICA experts
Project planning	workshops	workshops
Project monitoring	OJT	OJT
Tropical disease	3rd country training	3rd country training
Pest control	--------	Training in Japan
Presentation skills	IPCA, INCOSUR meetings	IPCA, INCOSUR meetings, International conferences

TABLE 6 Capacity building at health area level, (ETV)

Area of capacity building	ETV coordinator	ETVs
Vector biology	training by MSPAS	training by MSPAS
Chagas disease	OJT	OJT
Vector survey	training by MSPAS	training by MSPAS
Mapping	training by JICA expert	-------
Project planning	workshops	-------
Insecticide spraying	-------	OJT, training by MSPAS
Health education	By JOCV	By JOCV, OJT
Presentation skills	Quarterly meetings	-------
Data analysis	Quarterly meetings	-------

2.5. Implementation of social promotion

The establishment of an effective vector surveillance system with community participation is one of the major goals of the project. To achieve that goal, a variety of health education activities were implemented in the health areas, including production of educational materials, as described in Table 7.

TABLE 7 Availability of educational materials (type of material and recipient)

	Departmental level		Municipality	Community level		
	Doctor	ETV	Health post	Health personnel	Teacher, leader	Residents
Flyers				X	X	X
Poster			X	X	X	
Video		X	X	X	X	X
Flip chart					X	X
Manual				X	X	
Newspaper articles	X	X				
Magazine article	X	X	X			

One of the most effective activities was heath education through primary schools in Jutiapa. 1,343 school teachers participated in workshops about Chagas disease, vector surveillance,

and home improvement. As a result of the workshops, 815 vectors (548 adults and 267 nymphs) were detected and delivered by schools to the ETV department of the health areas.

2.6. Collaboration with other institutions

Throughout the project, MSPAS and JICA collaborated extensively with PAHO, USAC, and UVG-MERTUG/CDC. PAHO and JICA have collaborated extensively in the evaluation of the Chagas disease program in Guatemala, El Salvador and Brazil. In addition, PAHO and JICA are planning a joint regional meeting on vector control of *R. prolixus* in 2003. USAC and UVG-MERTUG/CDC provided technical assistance to the project as well as collaborating in the vector surveys and evaluation. Collaboration with organizations such as UNICEF, Union Europea, and Doctors Without Borders (MSF) has also been realized (Table 8).

TABLE 8 Area of cooperation with collaborating organizations

	Vector survey	Vector Control	Capacity building	Health education	Diagnosis	Treatment
PAHO/WHO		X	X		X	
UNICEF				X		
UNION EUROPEA			X			
MSF						X
USAC	X		X	X	X	
UVG-MERTUG/CDC	X		X	X	X	

2.7. Publicity about the project

Talks on progress of the project were presented in international and national conferences such as the International Conference on Malaria and Tropical Diseases, and PAHO's regional meetings. In addition, information on the project was broadcasted and published in national TV and radio programs , newspapers and magazines (JICA Frontier, Prensa Libre, Nuestro Diario, etc) and journals.

3. Financial input and cost-benefit analysis of the project

3.1. Input for the project

One of the key aspects of the project is that both MSPAS and JICA invested equally in

order to control the Chagas disease vectors. The input for the project is stated as follows.

TABLE 9 Input of MSPAS and JICA

	MSPAS	**JICA**
Human Resource/ Training	**(US$ 1,364,000.00)** ➢ 3 Counterparts (Central Level) ➢ 9 ETV teams (Health Area) ➢ 45 contracted sprayers (2000-2001) ➢ 76 contracted sprayers (2002)	**(US$ 1,500,000.00)** ➢ 2 long-term experts ➢ 5 short-term experts ➢ 1 Third-country expert ➢ 8 volunteers (JOCV) ➢ 2 third country training sessions ➢ 1 technical training in Japan
Materials, equipments, etc.	**(US$300,000.00)** ➢ Insecticide for 31,625 houses ➢ 93 manual Sprayers ➢ 4 vehicles ➢ Operational costs	**(US$1,170,000.00)** ➢ Insecticide for 127,500 houses ➢ 10 vehicles ➢ 204 manual sprayers, etc

3.2. Cost-benefit analysis

In order to examine the cost-benefit of the project, the cost of spraying per house was calculated. As shown below in Table 10, it was found that the major cost of spraying is the insecticide in Guatemala.

Table 10. Cost-benefit analysis of the project

	Cost	Cost/house
Insecticides	250,207.00	6.75
45 sprayers	63,823.12	1.72
Gasoline	3,725.24	0.10
Total	317,755.36	8.58

Among the insecticides recommended by WHO for use in triatomine control, JICA and MSPAS purchased deltamethrin, lambda-cyhalothrin, cifluthrin, and beta-cyfluthrin at the following prices shown in Table 11. In 2002, the price of the insecticides (deltamethrin) decreased from US$7.20 to US$4.50 per house, which decreased the cost of vector control per house substantially.

Table 11. Comparison of the price of insecticide

Insecticide	Commercial name	Formulation	Cost/house US$
Deltamethrin*	K-Othrine	5% Wettable Powder	4.50
Beta-cyfluthrin	Responsar	12.5% Suspensión Consentrate	6.40
Cyfluthrin	Solfac	10% Wettable Powder	14.00
Lambda-cyhalothrin	ICON	10% Wettable Powder	6.35

Deltamethrin(2,130kg.), Beta-cyfluthrin(1,385L.), Lambda-cyhalothrin(2.067kg.), and Cyfluthrin(120kg.) were purchased.

4. Advances in regional cooperation

Since Chagas disease vector control is a Central and South American initiative, regional cooperation between Guatemala and other countries has been realized through IPCA and INCOSUR. A variety of technical exchanges have been realized with Honduras, El Salvador, Nicaragua, and other Central American countries. Regional cooperation has also been implemented with Mexico and South American countries such as Chile, Paraguay, and Brazil.

Based on the success of Chagas disease vector control in Guatemala, JICA is extending its cooperation to El Salvador and Honduras. JICA dispatched a project coordinator to El Salvador to launch a vector control project in three departments. In Honduras, a vector control project is planned in three departments in 2003.

Regional cooperation, especially in the areas that border Guatemala, Honduras, El Salvador, and Mexico (state of Chiapas) will be also aided by Technical Country Cooperation (TCC) funds from PAHO.

5. Advances in other areas

Compared with other Central American countries, the Guatemalan medical system has limited facilities and resources has its weakness in blood screening, diagnosis, and treatment of Chagas disease. This weakness has been pointed out several times during IPCA meetings.

In order to improve the situation, the National Vector Control Program has held meetings with the National Laboratory, the National Blood Bank Program, UVG-MERTUG/CDC, USAC, and PAHO to develop national program of Chagas disease control which includes not only vector control, but also diagnosis, blood screening and treatment. An expert from Brazil was invited by JICA, and experts from Honduras were also invited by PAHO to provide technical assistance to Guatemala.

6. Recommendations

In order to free Guatemala from the vector transmission of Chagas disease, the followings are recommendations for continued and future goal.

6.1. Elimination of *R. prolixus*

- MSPAS should strive to be certified for the interruption of vectoral transmission of *T. cruzi* by *R. prolixus* by year 2005 (Zacapa, Jutiapa, Jalapa, Santa Rosa) and 2006 (Chiquimula, El Progreso, Baja Verapaz, and El Quiche).
- 100% of the houses of all the infested villages should be sprayed as soon as possible. Especially in Chiquimula, MSPAS should increase input to assure the coverage.
- 100% of the previously infested villages should be evaluated annually in order to assure the elimination.
- All the villages should be surveyed in Zacapa, Chiquimula, and Jalapa to assure the absence of the vector.
- A vector surveillance system with community participation should be established in the areas previously infested with *R. prolixus*.

6.2. Control of T. dimidiata

- 100% of the villages with domestic infestation indices higher than 5-10%, and all the houses with nymphs (signs of colonization) should be sprayed.
- Post-spraying evaluation by ETV should be implemented 6 –12 months after the spraying, and should be repeated to monitor domestic infestation and colonization.
- Vector control activities should be expanded to other infested departments such as Huehuetenango and Guatemala, where JICA does not participate in the control program.
- A vector surveillance system involving malaria volunteers, health promoters, Social Action

Group (GAS: Grupo de Action Social), and school teachers should be implemented in the areas with high domestic infestation rates.

6.3. Capacity building of vector control personnel

- An ETV manual which includes survey methods, spraying technique, evaluation methods, and health education should be developed and distributed.
- GPS should be introduced to some health areas in order to identify precisely the location of the vector.
- It is important to provide an opportunity for training as soon as possible to the Chagas disease program coordinator on diagnosis and clinical aspects of the disease in order to strengthen the national program against the disease.

6.4. Health education

- Priority should be placed on the establishment of a sustainable vector surveillance system with community participation
- A manual developed by a Japanese volunteer (Takero Nonami) should be distributed to health promoters, teachers, and community leaders to establish a surveillance system.
- Educational materials using illustrations only should be developed to provide information about the disease to the indigenous population who are not Spanish speakers

6.5. Regional cooperation

- JICA should endeavour to provide technical assistance in vector control to the state of Chiapas of Mexico, and to Nicaragua, and Panama.
- JICA should seek human resources such as JOCV and JICA experts in the area of GIS in order to introduce GIS to the vector control and surveillance programs in Central and South America.

6.6. Inter-institutional cooperation

- Collaboration with PAHO/WHO should be continued and strengthened through TCC, IPCA, organization of joint regional meetings, and participation in international evaluation missions of Chagas disease control. The dispatch of a former Japanese volunteer of the JICA Chagas disease control project (Ken Hashimoto) to the PAHO/WHO Guatemala

office as a technical advisor on Chagas disease control is an asset in strengthening the relationship between PAHO and JICA.

- MSPAS, JICA, USAC and UVG should collaborate to provide technical assistance to Chagas disease vector control in El Salvador and Honduras.

6.7. Diagnosis

- MSPAS should implement a serological survey of children in high-risk health areas such as Alta Verapaz, Baja Verapaz, El Progreso, El Quiche, and Huehuetenango to diagnosis the situation. The National Vector Program should coordinate with the National Laboratory, USAC and UVG to implement this activity.

- Regular meetings to improve diagnosis of the disease and blood screening with the participation of the National Vector Program, the National Blood Bank Program, the National Laboratory, PAHO, MSF and JICA, should be maintained and strengthened. UVG and USAC should be invited to the meetings to make the effort nationwide.