Report of the MPSSP/CCH Chagas' Disease Control Project Planning Meeting

November 26 - 30, 1990
La Paz, Bolivia

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Editors' Note

Many individuals have made significant contributions to this report. The final production, however, has been the responsibility of the editors. Despite attempts to integrate fully the comments and suggestions of numerous contributors, many deletions, modifications and additions have been necessary in order to produce a useful and cohesive document. Hence, this report represents, with considerable editorial bias, the collective viewpoints of its contributors. Although the editors can accept very little credit for its positive features, they accept full responsibility for any oversights, errors or misrepresentations in this report.

Acknowledgements

The editors wish to graciously acknowledge the support of this project by His Excellency, Jaime Paz Zamora, President of the Republic of Bolivia. In addition, the assistance and continued support of Chagas' disease activities in Bolivia by the following individuals are gratefully acknowledged: Dr. Mario Paz Zamora, Minister of Health for Bolivia; Dr. Guillermo Cuestas, Sub-Secretary of Health for Bolivia; Dr. Jack Antelo, Director General of Health for Bolivia; Dr. Roberto Vargas, National Director of Epidemiology for Bolivia; Mr. Robert Gelbard, U.S. Ambassador to Bolivia; Mr. Karl Leonard, Director, USAID/La Paz; Dr. Walter Dowdle, Deputy Director, Centers for Disease Control, U.S. Public Health Service; Dr. Joseph Davis, Director, International Health Program Office, CDC; and Dr. Alvaro Munoz-Reyes, Director, Community and Child Health Project, USAID/La Paz.

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The efforts of Dr. Andy Arata and the Vector Biology and Control Project in facilitating and sponsoring the attendance of selected consultants at this meeting are also very much appreciated.
Finally, special acknowledgements go to Dr. Joel Kuritsky and Mr. Paul Hartenberger, without whose efforts the initiation of USAID/CCH support of a Chagas' disease control program in Bolivia would never have occurred.

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1. Executive Summary

A planning meeting for the MPSSP/CCH* Chagas’ Disease Control project was held in La Paz, Bolivia from November 26 to 30, 1990. Support for this meeting was provided by USAID/La Paz and the Vector Biology and Control Project. The meeting was officially opened by His Excellency, Jaime Paz Zamora, President of the Republic of Bolivia. Also in attendance at the opening ceremony were officials from the Bolivian Ministry of Health, the U.S. Department of State and the U.S. Public Health Service.

Participants in the meeting included professionals from Bolivia, Argentina, Brazil, Venezuela, Belgium and the United States. These individuals represented a wide array of scientific institutions and disciplines, including the social sciences, entomology, epidemiology, housing and laboratory sciences.

The meeting was convened to initiate planning of Chagas’ disease control activities in Bolivia and to provide guidance to the newly formed MPSSP/CCH Chagas’ Disease Control Project. Specific objectives were as follows:

1. Review existing information on Chagas’ disease control and prevention in Bolivia and other endemic countries.

2. Develop protocols and plans of action in community development and health education, vector control, house modification, epidemiology and laboratory methodology for use in pilot projects.

3. Prepare guidelines for the establishment of a National Committee on Chagas’ Disease Control.

4. Propose operational and basic research activities appropriate for Bolivia, particularly in transfusion-related and congenitally transmitted Chagas’ disease.

* Ministerio de Prevision Social y Salud Publica/Community and Child Health
5. Propose guidelines for coordination among institutions and integration with existing vector control activities within a national Chagas' disease control program.

6. Develop means to foster donor interest in a large-scale, sustainable Chagas' disease control program for Bolivia.

7. Prepare a meeting report to serve as a guide for achieving program objectives and define methods for program evaluation.

The preceding objectives were designed to provide a foundation for the broader objective of the MPSSP/CCH Chagas' Disease Control Project:

1. Begin coordinating Chagas' disease control and research activities in Bolivia and establish a National Committee on Chagas' Disease Control.

2. Compare, with standardized methods of epidemiologic, entomologic, and socio-economic evaluation, the efficacy, efficiency, sustainability and local acceptability of Chagas' disease control strategies in four pilot areas: Tupiza, Tarija, Chuquisaca and Cochabamba.

3. Use the data generated form these pilot studies to plan a national control program and obtain commitments from donors to provide monetary and technical support for Chagas' disease prevention and control in Bolivia.

This meeting was organized into six working groups composed of eight to fifteen professionals each. Each group was assigned one of six topics: community development/participation and health education; vector control; house modification; epidemiology; laboratory support; and the National Committee on Chagas' Disease Control. Intergroup interaction was strongly encouraged and meetings with group moderators and meeting organizers were held
daily. Moderators compiled and organized the contributions of group members and, by the end of the meeting, written summaries from each moderator were available. These group summaries formed the basis for this report (see Editors’ Note).

Group moderators and other key individuals met after the formal closing of the planning meeting to integrate ideas and formulate specific plans and recommendations. They concluded that the two-year period from January 1991 to December 1992 would constitute a pilot phase for the MPSSP/CCH Chagas’ Disease Control Project. During the pilot phase, operational research would be conducted to meet planning meeting and program goals, emphasizing an integrated, community-based approach to control.

It was recommended that small, manageable pilot sites be selected from each of the four major Chagas’ disease endemic regions of Bolivia: Potosí (Tupiza), Chuquisaca (Sucre), Tarija and Cochabamba. Pilot sites in each of these four regions will consist of three to four communities of fifty to one hundred households each. Control programs are already present in the areas around Tupiza, Sucre, and Tarija, so existing infrastructures and control strategies will be used in newly selected pilot sites within these regions. These existing programs will receive technical and financial support from CCH.

In the Cochabamba region, the most promising control strategies from the three existing programs, plus modified or additional interventions, will be combined to initiate a control program at pilot sites. CCH will also provide technical and financial support for these activities. Pilot sites in the Cochabamba region will, in essence, be the demonstration sites for the intervention, surveillance and evaluation techniques collectively proposed by planning meeting participants.

Baseline evaluations, interventions (education, house improvement and insecticide application) and follow-up evaluations will be conducted simultaneously in all pilot sites. Furthermore, all pilot sites will be subjected to the same standardized methods of epidemiologic, entomologic and socio-economic evaluation. Standardized evaluation will allow for objective, scientific comparisons between the four regions and enable program scientists to draw meaningful
conclusions about the impact of various intervention strategies. It was recognized, however, that this two-year pilot phase is tightly scheduled and its success is highly dependent upon efficient management, particularly of funds, personnel and necessary commodities.

In addition to the comparative field trials described above, numerous other lines of operational research were recommended. Given top priority, however, were recommendations for protocols designed to assess the public health impact of Chagas' disease due to blood transfusions and congenital transmission, and to develop preventive interventions.

In an early effort to ensure coordination of Chagas’ disease related activities in Bolivia, planning meeting participants also recommended the formation of a National Committee on Chagas’ Disease Control. It was proposed that this committee consist of representatives from the major Bolivian and foreign organizations with projects or interest in Chagas’ disease. This committee will report directly to the Minister of Health and its functions should include coordinating the Chagas’ disease-related activities of various agencies, reviewing new Chagas’ projects, evaluating existing projects to ensure that they follow Ministry of Health guidelines, and obtaining additional funds to carry the project forward after its initial pilot phase is completed. Committee members also will be responsible for forming a technical subcommittee to advise them on scientific matters.

Finally, it was considered essential that an external evaluation team review the entire project after the first year and at the end of the program. Guidelines for such an evaluation are provided.

As noted in the project objectives and elsewhere, the intent of this Project is to move beyond the pilot phase to a broader long-term phase by successfully soliciting substantial donor support. This evolution will be accomplished by convincing donors and the international scientific community that the pilot phase has produced objective, scientifically valid information that can serve as a solid base for subsequent control and research efforts. Moreover, the pilot phase should demonstrate that the intervention strategies involved are sustainable and make significant contributions to
community well-being that extend far beyond the scope of Chagas' disease alone. As Carlos Chagas noted many decades ago, this is a socio-economic disease. Since then, successful control programs have been conducted in several Latin American countries. Control of Chagas' disease in Bolivia, therefore, is attainable with appropriate levels of funding and long-term commitments by agencies providing financial and technical assistance.
2. Introduction

Chagas' disease occurs only in the Americas and is caused by the protozoan parasite, *Trypanosoma cruzi*. It is transmitted to humans by triatomine bugs, through blood transfusion and congenitally from mother to child.

The World Health Organization estimates that the prevalence of *T. cruzi* infection reaches 16 million cases. About 90 million people, or 25 percent of the total Latin American population, are at risk. An estimated 10 to 30 percent of those infected may suffer chronic symptoms and about 10 percent may die.\(^1\)

Chagas' disease is endemic over a large area of Bolivia. The vector occurs in about 80 percent of the country, excluding altitudes above 3,500 meters, and approximately two-to-three million people are at risk for infection with *T. cruzi*. It has been demonstrated that the prevalence of infection in humans from "chagastic" areas ranges from 50-70 percent. Age-stratified results are even more disturbing. They show that in some rural areas, 70 percent of children younger than five are infected. Overall, about 35 percent of school-age children in "chagastic" areas are infected with *T. cruzi*.\(^2\)

The impact of Chagas' disease on the socio-economic development of the country must be enormous, but this has been not studied. Bolivia has no national Chagas' disease control program, although there are a number of small programs as well as one larger control program in Tupiza. Unfortunately, there is little coordination or information exchange between projects.

Reports on the severity of the disease and the lack of a coordinated control effort have led to the incorporation of a Chagas' disease component into the USAID Community and Child Health Project (CCH) in Bolivia. This component is consistent with the child survival interventions on which the overall project is based. Called the MPSSP/CCH Chagas' Disease Control Project, the component will be linked directly with the Ministerio de Prevención Social y Salud Publica.
The project will begin with a two-year pilot phase (1991-1992) that will serve as the basis for long-term, sustainable Chagas' disease control activities in Bolivia. The project will include, but not be limited to, the following:

1. Design operational research to identify intervention and evaluation techniques that are most appropriate for Bolivia; define and prioritize basic research needs relevant to controlling Chagas' disease in Bolivia.

2. Develop Chagas' disease surveillance systems.

3. Train Bolivian nationals in the use of computers for surveillance and other epidemiologic activities.

4. Improve national and regional laboratory capability, including standardization of procedures and quality control.

5. Develop training courses about prevention of Chagas' disease for rural health educators.

6. Standardize the type and amount of insecticide used in spraying programs, frequency and method of application, evaluation of insecticide efficacy and the community's role in application and evaluation.

7. Standardize (with appropriate regional variations) construction techniques to be used in community-based house improvement programs.

8. Develop improved methods for separating humans from T. cruzi vectors and reservoir hosts.


10. Establish working partnerships with other donors for Chagas' disease control.
2.1 Objectives of the meeting

A planning meeting was held from November 26 - 30, 1990, in La Paz, Bolivia. The objectives were as follows:

a. Review existing information on Chagas' disease prevention and control in Bolivia and other endemic countries.

b. Develop protocols and plans of action for community participation and health education, vector control, house modification, epidemiology and laboratory methodology for use in pilot projects.

c. Prepare an outline for the establishment of a National Committee on Chagas' Disease Control.

d. Suggest research activities, particularly studies on blood transfusion and congenital transmission of Chagas' disease, and indicate national laboratories capable of doing the research.

e. Define the basis for establishing a national Chagas' disease control program, integrating it with existing vector control activities and promoting technical participation among Bolivian institutes.

f. Prepare a meeting report that will serve as a guide for achieving the long- and short-term objectives of the program; define methods to evaluate program activities.

g. Develop methods to promote interest in Chagas' disease control among donor countries and agencies.

2.2 Objectives of the program

The program will begin during the first quarter of 1991, using information obtained from the planning meeting to guide its activities. The program's principal objectives are as follows:
1. Begin coordinating Chagas' disease control and research activities in Bolivia and establish a National Committee on Chagas' Disease Control.

2. Compare, with standardized methods of epidemiologic, entomologic and socio-economic evaluation, the efficacy, efficiency, sustainability and local acceptability of Chagas' disease control strategies in four pilot areas: Tupiza, Tarija, Chuquisaca and Cochabamba.

3. Use the data generated from these pilot studies to plan a national control program and obtain commitments from donors to provide monetary and technical support for Chagas' disease prevention and control.

In order to carry out a national Chagas' disease control program, sufficient funding must be obtained from donors to maintain the program for 15 to 20 years. At the same time, the program would establish a revolving funding system for interest-free or low-interest rural house improvement loans (or other methods of economic support) to ensure its continuation. To achieve these goals, the following short-term objectives are required:

a. Implement a pilot study to control Chagas' disease through community participation, health education, vector control and house improvement; and develop a system for monitoring and evaluating the interventions.

b. Develop the necessary tools for health education and promote community involvement to ensure community support of the project.

c. Test and select suitable chemical control methods and develop a strategy, including evaluation, for their use.

d. Develop and test house improvement construction methods and materials to ensure that the improvement measures are durable.
e. Develop and test field laboratory methodology to evaluate progress.

f. Obtain an immediate impact on Chagas' disease transmission through a combination of interventions.

g. Demonstrate that such community-based control interventions as house improvement are successful and sustainable.

h. Develop a scope of work for the National Committee on Chagas' Disease Control and select its membership.

i. Enlist the collaboration of research institutions and existing rural development programs with the National Chagas' Disease Control Project.

j. Study Chagas' disease childhood morbidity and mortality as well as techniques for prenatal and neonatal screening for Chagas' disease.

k. Develop strategies for evaluating the public health impact of transfusion-related Chagas' disease in major urban areas and recommend ways to lower the risk for this mode of transmission.

2.3 Terms of reference

A project paper amendment was approved to create a Chagas' disease component for the Community and Child Health Project. The name of this component will be the MPSSP/CCH National Chagas' Disease Control Project. The project will work directly with the MPSSP. Consultants to the project will include entomologists and other specialists from the Vector Biology and Control Project of Arlington, Virginia, epidemiologists from the Centers for Disease Control of Atlanta, Georgia, and experts from other Latin American countries.
Initial funding will be from USAID, P.L. 480 and the VBC project. Additional funds will be sought from other donors during the life of the project.

Links with other MPSSP Projects

Since the Community and Child Health Project is part of the National Program for Maternal-Child Health, administration of the Chagas' disease component will be placed there. The MPSSP Department of Epidemiology will coordinate technical activities, particularly insecticide spraying. Field activities may include cooperation with health units and malaria services at the department level.
3. Background

3.1 Chagas' disease endemic areas

It is generally accepted that the Chagas' disease endemic areas of Bolivia are found between 300 and 3,000 meters above sea level. This region represents approximately half of the Bolivian territory (500,000 square kilometers and a population of 3,196,000). Although the vector has been found in areas above 3,500 meters, its dispersion and density above 3,000 meters are quite low.9

The endemic region of Bolivia encompasses virtually all the territory of the departments of Cochabamba, Chuquisaca, Santa Cruz and Tarija and extends to some areas within the Departments of La Paz and Potosí (See Map 1).

Data from studies of *Triatoma infestans* household infestation rates stratified by altitude conducted in the Departments of Santa Cruz and Cochabamba are shown below in Table 1.

This table shows that household infestation rates (which represent endemicity) are highest at altitudes of 1,000 to 2,000 meters above sea level. In all likelihood, however, altitude is not the most important influence on infestation rates. Many other factors linked to the household environment, such as the socio-economic-cultural influences mentioned below, affect infestation rates. Rates of triatome infection with *T. cruzi*, on the other hand, appears to have no relation to altitude.
AREA CHAGASICA EN BOLIVIA

REFERENCIAS
Area Chagásico

UBICACION EN AMERICA DEL SUR
Table 1

Index of triatome infestation of houses and index of infection of triatomes with *T. cruzi* by altitude and provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Altitude</th>
<th>House Infestation %</th>
<th>Rate of T. cruzi infection in triatomes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Intradom.</td>
</tr>
<tr>
<td>A.de Ibañez</td>
<td>450</td>
<td>25.7</td>
<td>59.0</td>
</tr>
<tr>
<td>Cordillera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Gut.e Ipita)</td>
<td>600-1100</td>
<td>70.5</td>
<td>40.2</td>
</tr>
<tr>
<td>(Vg de trigal)</td>
<td>1500</td>
<td>37.4</td>
<td>40.0</td>
</tr>
<tr>
<td>Punata</td>
<td>2500-2999</td>
<td>29.4</td>
<td>58.0</td>
</tr>
<tr>
<td>Mizque</td>
<td>1500-1999</td>
<td>49.0</td>
<td>46.5</td>
</tr>
<tr>
<td>Mizque</td>
<td>2000-2499</td>
<td>45.5</td>
<td>52.8</td>
</tr>
<tr>
<td>Mizque</td>
<td>2500-2999</td>
<td>28.0</td>
<td>50.7</td>
</tr>
<tr>
<td>Mizque</td>
<td>3000 y más</td>
<td>13.4</td>
<td>53.0</td>
</tr>
</tbody>
</table>
3.2 Socio-economic and cultural factors

Bolivia has an extremely young population. More than half the people fall within the 0 to 18 year age group. Moreover, the annual population growth rate is 2.8 percent. By the year 2000, the population is expected to reach 10 million.

Bolivia’s economic problems increased during the last decade because of a lack of agrarian development and a high annual urban population growth rate (4.4 percent). Young people and recent migrants with few job opportunities in the urban market have contributed significantly to this growth.

Population and socio-economic factors have a significant impact on Chagas’ disease in Bolivia. For example, depending on the geographic zone in question, the degree of human association with domestic animals varies. Domestic animals are important to most rural Bolivians as a source of food and as pets. This relationship with domestic animals can be very important. *T. cruzi* infection rates in triatomes captured in rabbit pens have reached 78.3 percent, compared to 58.0 percent in triatomes captured within households.¹

Both cultural restraints and a marginal economy may limit the willingness of rural inhabitants to modify their animal husbandry practices. The same applies to the storage of household goods, which also can create favorable conditions for contact between humans and triatomes.

In one study comparing families with children seropositive for *T. cruzi* to a similar group of seronegatives, it was demonstrated that conditions and infestation rates were similar, but infection rates in triatomes captured in bedrooms were higher in the seropositive group (77 percent) than the seronegative group (34 percent).² These findings suggest that even in similar economic and social situations, certain factors related to sleeping quarters may contribute to the infection of inhabitants.
In certain areas of the country, it is considered normal to have even large numbers of triatomine bugs in houses. For example, 5,000 were captured in a single house in Villa Granado, Campero Province.6

3.3 Transmission by insect vectors

Three modes of entomologic vector transmission exist in this country. The first is sylvatic transmission in which wild and synanthropic mammals such as rabbits are the reservoir hosts. The second mode of transmission occurs in rural housing, where socio-economic and cultural factors such as poor house construction, close proximity to domestic animals and improper storage of household goods provide favorable conditions for household colonization of triatomes. The third mode occurs in peri-urban areas where socio-economic and cultural factors are combined with overcrowding in regions where accelerated rural-to-urban migration is occurring.

The principal vector of Chagas' disease in Bolivia is *Triatoma infestans*, which is captured at a ratio of 99:1 relative to other vectors. Second in order of importance is *Triatoma sordida*, which prefers peridomestic sites. Twelve other species of triatomes have been reported, but their epidemiologic significance is unknown (La Fuente et al, 1986; Bermudez, personal communication.)

Table 2 shows the dispersion of *T. infestans* and its density per household by altitude as determined by the one man/hour/house method.
Table 2
Dispersion and Density Index by Altitude of *T. infestans*

<table>
<thead>
<tr>
<th>Altitude Investigated</th>
<th>Number Positive</th>
<th>Dispersion Index</th>
<th>Density per house (%)</th>
</tr>
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<tbody>
<tr>
<td>300-1000</td>
<td>27</td>
<td>87.1</td>
<td>1.3</td>
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<td>1001-2000</td>
<td>15</td>
<td>84.2</td>
<td>6.8</td>
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<tr>
<td>2001-3000</td>
<td>40</td>
<td>97.6</td>
<td>4.2</td>
</tr>
<tr>
<td>3001-3500</td>
<td>4</td>
<td>22.3</td>
<td>0.5</td>
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</table>

*Source: National Epidemiological Investigation of Chagas’ Disease*

Some zones in Bolivia have extremely high house infestation rates. For example, in the province of Campero in Cochabamba, more than 5,000 triatomines were captured in a single house. Such high levels of household triatome infestation may influence the degree of anemia in children who live in these homes. (A single triatome is capable of ingesting .25 to .50 ml of blood.) In heavily infested areas, where it is not uncommon for as many as 50 triatomines to feed on one child in a single night, blood losses of up to 25 ml/day could easily occur.

*T. cruzi* transmission among animals by sylvatic *T. infestans* has been identified in the Department of Cochabamba. The *T. cruzi* strain has been found to be the same as that found in the domestic cycle in Cochabamba (Dujardin et al. 1987). However, the actual limit of sylvatic *T. infestans* distribution is unknown. The species, distribution, natural ecotopes and other biological factors of sylvatic vectors other than *T. infestans* are poorly understood. The enzootic transmission of *T. cruzi* by species other than *T. infestans* is shown in Map 2.
Map 2. Areas Endemic for *T. cruzi* and Its Vectors in Bolivia

- Area Endemic for *T. cruzi*. vectors: *T. infestans*, *T. sordida*
- Area Enzootic for *T. cruzi*. vectors: "Sylvatic" *T. infestans*
- Area Enzootic for *T. cruzi*. vectors: "Sylvatic" Triafomine vectors
3.4 Congenital transmission of Chagas’ disease

In studies conducted in the maternity ward of Percy Boland Hospital in Santa Cruz, it was determined that 25 of 329 (7.6 percent) newborn infants were parasitologically positive for T. cruzi. One hundred sixty-one of the 329 (50.8 percent) mothers were seropositive, suggesting a risk for transmission of approximately 16 percent. Considering that the majority of patients attending this maternity ward live in peri-urban areas, it is reasonable to assume that congenital transmission rates are even higher in highly endemic rural areas.

3.5 Chagas’ transmission by blood transfusion

Blood transfusions occur frequently in Bolivia for several reasons, including local standards for medical practice, increases in major surgery, and traffic accidents. Blood banks, however, are rare; most areas of the country have no facilities for storing blood. Consequently, the majority of transfused blood is obtained from family members or "donors" who sell their blood products for cash. Serologic screening of transfused blood occurs rarely, if at all. Pretreatment with agents such as gentian violet is impossible due to the lack of storage facilities.

In one study conducted in the city of Santa Cruz, 40 of 69 seronegative patients received blood from seropositive donors. Of the 21 patients who received parasitologic follow-up, 10 (47 percent) were positive for T. cruzi 60 days after their transfusions. These data suggest that people who receive blood transfusions in Bolivia are at high risk for Chagas’ disease.
3.6 Human infection

3.6.1 Acute phase

Little research on the acute phases of Chagas' disease has been conducted in Bolivia. However, data indicate that in one active detection program, the mortality of acute Chagas' disease approached 15 percent. Other reports have cited mortality rates as high as 85 percent.

Diagnosis of acute Chagas' disease is based on parasitologic methods, but serologic assays (immunofluorescence) for anti-*T. cruzi* IgM antibodies are sometimes helpful.

3.6.2 Latent or indeterminate phase

Serologic assays (e.g., complement fixation, indirect hemagglutination, ELISA) for indirect diagnosis have also been helpful in determining the prevalences of *T. cruzi* infections in various regions of Bolivia. In one peri-urban area near the city of Santa Cruz (416 meters above sea level), a seroprevalence of 11 percent was reported in children younger than five years of age. In other areas, the seroprevalence in this age group has ranged from 20 to 25 percent. These same studies report that seroprevalence increases dramatically in the 30 to 35 year age group: 52.7 percent in Porongo, 70.6 percent in Guitierrez Ipita, and 70 percent in El Trigal. A national serologic survey also indicates that seropositivity tends to increase with age, in this case from 40 percent in persons 15 years and younger to 45.8 percent in persons aged 30 to 34 years. Seropositivity rates tend to level off after age 34 (Table 3).
Table 3
Serological Prevalence of Chagas' Disease in Bolivia (9)

<table>
<thead>
<tr>
<th>Age groups</th>
<th># Examined</th>
<th># Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>372</td>
<td>83</td>
<td>22.3</td>
</tr>
<tr>
<td>5 - 9</td>
<td>1365</td>
<td>472</td>
<td>34.6</td>
</tr>
<tr>
<td>10 - 14</td>
<td>1520</td>
<td>596</td>
<td>39.2</td>
</tr>
<tr>
<td>15 - 19</td>
<td>1113</td>
<td>459</td>
<td>41.2</td>
</tr>
<tr>
<td>20 - 24</td>
<td>876</td>
<td>394</td>
<td>45.0</td>
</tr>
<tr>
<td>25 - 29</td>
<td>832</td>
<td>360</td>
<td>43.3</td>
</tr>
<tr>
<td>30 - 34</td>
<td>714</td>
<td>327</td>
<td>45.8</td>
</tr>
<tr>
<td>35 - 39</td>
<td>631</td>
<td>256</td>
<td>40.6</td>
</tr>
<tr>
<td>40 - 44</td>
<td>543</td>
<td>240</td>
<td>44.2</td>
</tr>
<tr>
<td>45 - 49</td>
<td>452</td>
<td>187</td>
<td>41.4</td>
</tr>
<tr>
<td>50 - 54</td>
<td>320</td>
<td>133</td>
<td>41.6</td>
</tr>
<tr>
<td>55 - 59</td>
<td>258</td>
<td>121</td>
<td>46.9</td>
</tr>
<tr>
<td>60 - 64</td>
<td>265</td>
<td>116</td>
<td>43.8</td>
</tr>
<tr>
<td>65 - +</td>
<td>281</td>
<td>108</td>
<td>38.4</td>
</tr>
</tbody>
</table>
3.6.3 Chronic phase

Although it may appear that chagastic heart damage is not necessarily a high-priority public-health issue in Bolivia, a review of existing data indicates that it is significant. Twenty-six percent of the infected population has cardiac damage, which causes progressive incapacitation and subsequent economic and social impact on community and family members. Table 4 shows the prevalence of heart damage in various regions of Bolivia.\textsuperscript{9,12}

In addition to cardiac pathology, gastrointestinal manifestations of Chagas' disease are also found in Bolivia. For example, swallowing times (an indirect measure of esophageal dysmotility) were abnormally prolonged in 16 percent of seropositive individuals in one small community in the Department of Cochabamba (Pless, et. al). In one hospital in the city of Tarija, 3.4 percent of approximately 7,000 patients undergoing gastrointestinal surgery had evidence of megacolon or other pathology suggestive of Chagas' disease (MPSSP, US, Tarija).

Electrocardiogram (EKG) abnormalities most frequently encountered include bradycardia, right bundle branch block, left anterior hemi-block, atrio-ventricular block, and incomplete right bundle branch block.
Table 4
Prevalence of Cardiomyopathy in Persons Older than Five and Estimation of the Risk for Sudden Death by Locality

<table>
<thead>
<tr>
<th>Locality</th>
<th># EKGs performed</th>
<th># With Abnormal EKGs*</th>
<th>Suspected infections</th>
<th>Risk of death (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porongo</td>
<td>415</td>
<td>37</td>
<td>8.9</td>
<td>2.4</td>
</tr>
<tr>
<td>Gut. e</td>
<td>453</td>
<td>43</td>
<td>9.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Ipita</td>
<td>348</td>
<td>39</td>
<td>11.2</td>
<td>1.4</td>
</tr>
<tr>
<td>Trigal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Est.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>7,696</td>
<td>1008</td>
<td>13.1</td>
<td>-</td>
</tr>
</tbody>
</table>

* Electrocardiogram (EKG) abnormalities most frequently encountered include bradycardia, right bundle branch block, left anterior hemi-block, atrio-ventricular block, and incomplete right bundle branch block.
4. Pilot Phase Design and Regions Selected for Participation

The 1991-1992 pilot phase will emphasize operational research. Relatively small, manageable pilot sites will be selected from each of the four major endemic regions: Department of Potosí, in the rural areas surrounding the city of Tupiza; Department of Chuquisaca, in the rural areas near Sucre; Department of Tarija, in rural areas near the city of Tarija; Department of Cochabamba, in rural areas east and south of the city of Cochabamba. Pilot areas in each of these four regions will consist of three or four communities, or localities, of 50-100 households each, a maximum of 1,600 houses and approximately 8,000 individuals.

Whenever possible, existing infrastructures and control strategies will be used in the regions of Tupiza, Sucre and Tarija. These existing programs will receive technical and financial support from CCH.

In the Cochabamba region, the most promising strategies from the three existing programs, as well as additional or modified intervention, will be combined to initiate a control program in newly selected pilot sites. CCH also will provide technical and financial support for these activities. Pilot sites in the Cochabamba region will, in essence, be the demonstration sites for the new or modified interventions, surveillance, and evaluation techniques collectively proposed by the participants at this planning meeting. To increase efficiency, avoid wasteful duplication, and decrease costs, Chagas’ disease control activities in this region will be closely integrated with existing (but non-Chagas’ disease-related) infrastructures for health improvement and/or agricultural development.

Cochabamba is an ideal pilot region because: 1) of the presence of UMSS and National Entomology Laboratory facilities; 2) Projects exist with the potential for attracting various forms of support (USAID, CARE, PMA, MPSSP); 3) this region is endemic for both Chagas’ disease and malaria, making it possible to test
combined vector control approaches; and 4) sylvatic *T. infestans*
has been documented in the area, which will allow the study of the
effect of sylvatic vectors on control programs.

Prior to initiating control efforts in newly selected pilot sites
near Tupiza, Tarija and Sucre, a MPSSP/CCH technical team will
visit each of these projects. The team will assist in identifying
existing problems, advising project staff on possible solutions and
suggesting specific, operational research protocols to address these
problems. This technical team also help select specific pilot sites in
these regions as well as in Cochabamba.

Baseline evaluations, interventions such as education, house
improvement or insecticide application, and follow-up evaluations
will be conducted simultaneously in the pilot sites of all four
regions. All pilot sites will be subjected to the same standardized
methods of epidemiologic, entomologic, and socio-economic
evaluation. The four pilot phase regions are described below.

4.1 Cochabamba

The most important endemic areas are from Mizque-
Aiquile south towards the Departments of Chuquisaca and Potosí,
and east towards the endemic areas of Santa Cruz. Although virtually no Chagas' disease control activity has occurred in this area,
CARE has a project of which Chagas' disease is a component in
Aiquile, and the UMSS, IBBA, and ORSTOM have done basic and
field research in the area.

4.2 Chuquisaca

There is no government-sponsored Chagas' disease control
program in the area. However, Foster Parents' Plan International
has a training program for rural health staff and is involved in some
house improvement. The Proyecto Social Boliviano Británico
"Cardenal Maurer" also has a small, well-designed and managed
Chagas' disease control project that emphasizes house improve-
ment. Finally, CARE has projects in the department in which
Chagas' disease control is a component.
4.3 Tarija

Some residual spraying has been done by the MPSSP in the urban-rural fringe of the city, but it is very limited. CARITAS and CARE projects operate broad-based health and development programs in the department. The CARE program includes economic development, community organization and provision of potable water, latrines and house improvements.

On the other hand, both CARITAS and the Unidad Sanitaria, MPSSP (US/MPSSP) have written detailed proposals for Chagas' disease control in this region. The early experience and preliminary data of the US/MPSSP will guide further activities in Tarija.

4.4 Tupiza

The US/MPSSP, in cooperation with FIDA and PMA, has maintained a regional Chagas' disease control program since 1986. The program takes an integrated approach (education, house improvement, insecticide) that is conducted in four phases: preparation, attack, consolidation and evaluation. The program operates in three provinces (Nor Chichas, Sur Chichas and Modesto Omiste), and including some 10,000 households with a population of approximately 50,000 in 185 communities.
5. Criteria for Study Site Selection

The following list of factors will be considered for selection of study sites within the four areas. A numerical value from one to four will be used to rank each factor. (1=poor, 2=acceptable, 3=very good, and 4=excellent)
<table>
<thead>
<tr>
<th>Factor*</th>
<th>Cochabamba</th>
<th>Chuquisaca</th>
<th>Tarija</th>
<th>Tupiza</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Geographic accessibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Community organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Existing aid project</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Existing health services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Defined population center</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Social/economic/cultural/education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Home ownership</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Community interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Human migration rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Condition of houses**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Prev. epidemiologic results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Prev. entomologic results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* A manual will be prepared for detailed explanation of each factor.

** Condition of the majority of houses in communities.
6. Methods of Intervention and Evaluation

Five subgroups met to cover the topics discussed in this section. The linking of activities will vary with the location of the pilot sites and the actions to be taken in each. Consequently, although there was an exchange of ideas between the subgroups, actual coordination of activities will be planned after pilot sites and villages are selected.

6.1 Community participation and health education

Most often, community participation begins when a health promoter or other activist proposes changes in the community’s social structure. Community members discuss common concerns with the health promoter, develop a plan of activities, and assign tasks. Success (a positive community response) depends on how well the health promoter fulfills his or her duties and responds to commitments made by the community. A highly trained and well-motivated health promoter is the starting point for community participation.

In the MPSSP-CCH Chagas' Disease Project, an independent group with experience in community organization might be contracted to manage and promote the process of participation. This process probably will take longer than the two years of the pilot phase.

Several aspects of community participation depend on the organizational and political level of the community and society. Bolivia has a high level of organization among community committees, labor unions, mothers' clubs, and family networks. Effective community participation implies working closely with these local organizations and family units.
6.1.1 Factors that explain or allow community participation to function

To a large extent, community participation requires behavioral change for those involved. Three groups of factors influence this change.

Beliefs, habits and aspirations of the community

- beliefs about disease and health
- beliefs about Chagas’ disease
- an understanding of the vector’s role in causing Chagas’ disease
- assessment of household conditions and understanding of methods to improve housing
  - relationship of domestic animals to the household environment
  - habits related to cleanliness and storage of items in the house
  - habits related to use of the peridomestic environment
- sanitation habits
- life aspirations

Circumstances

- family roles and tasks related to change within the family structure
- migration pattern of the labor force
- patterns of family income/economy
- level of social organization, forces behind organization and major community achievements
- types of leaders and leadership patterns
- type of house-compound construction and condition
- cultural traditions, ethnic and linguistic composition
Interactions between health promoter and community

- ability of health promoter to fulfill duties
- quantity and quality of community participation during the different phases of the project (diagnosis, decision-making, implementation and evaluation)
- credibility of health promoter within the community

6.1.2 Criteria for selecting study areas and villages

A model emphasizing community participation has been designed. Adjustments are required depending on the level of existing health or rural development projects in the area. Medium-sized communities may be easier to work with than small or large ones. Care should be taken to select only communities with the greatest potential for success.

Selection criteria, determined by all groups, can be found in Section 5. Specific anthropological criteria are presented later in this section.

6.1.3 Evaluation of community participation

A number of projects of the MPSSP and PVOs (e.g. Proyecto Británico in Chuquisaca) were reviewed. The experiences of rural house improvement projects in Venezuela also were discussed. It was noted that each project had a very positive result but it was too early to form conclusions on sustainability. In every case, success was closely linked to leadership at all levels of the project and the ability of the health promoter to execute his or her duties successfully. In addition, each project had good baseline studies with a strong education and communication component.
6.1.4 Research requirements and evaluation of techniques

Rapid evaluation of certain beliefs and habits that permit improved education about health and Chagas' disease is important. Social techniques should be developed in accordance with the experiences of other countries and should be field tested before being used widely.

6.1.5 Sequence and timing of community participation and education

Baseline information should take a maximum of four months to complete. The following must be considered in order to gather baseline information.

- The field team should have cultural ties to the area and speak its language. The team should be trained specifically for the project.

- Information about beliefs and social customs should be as complete as possible.

- One-on-one and small group contact using both dialogue and material with graphics are important ways to communicate with the community.

- The active participation of organized social groups within a community must be considered when obtaining baseline information. Data should be presented back to the community with graphics that include a diagnosis of what changes are required.

- The community should choose and organize its own committee to implement the required tasks.

Intensive sanitary education should require four months, followed by reinforcement for six months.
o The educational process should be a dialogue between health promoter and community with ample flexibility between both.

o A specific set of educational activities should be developed. These should include small-group dialogues and mass-media messages using radio, posters and audiovisual material. The mass-media campaigns should come first and continuously reinforce group activities.

o Educational strategy should be based on what is practical and demonstrable to the community.

o Educational strategy should focus first on vectors, then the disease and finally households. Professionals who are involved in the process must first know the community, its impression of the problem and suggested solutions.

o Points to be stressed depend on the target audience. For example, mothers should be informed about the dangers to their children.

o The approach to different target audiences will vary: games, drawing and fairs for the children; radio dramas, group discussions and posters for the parents.

o Training for health promoters, insecticide sprayers and construction supervisors should include manuals with graphics depicting the working process and only a simple text.

The house improvement phase will last three or four months. Education and community participation will be linked closely to actual construction.
o House design and any alteration of the peri-domestic environment should be compatible with the local economy and culture. Activities in this phase depend upon community organization and motivation, flexibility and the success of the health promoter. These activities may have to be reinforced through gifts recognizing the achievements of participating families.

o Training of house construction experts (supervisors and trainers for community actions) and local workers will be required.

Insecticide spraying at the time of house modification and any subsequent insecticide applications, regardless of type, will be linked with construction and the success of activities to eliminate vectors. Care must be taken so that the disappearance of vectors after insecticide spraying does not reduce motivation for maintaining house improvements.

o The steps to be followed depend upon the type and formulation of the insecticide, its toxicology, and the individuals doing the applications. Training and manuals will be developed accordingly.

o Each house will be visited before any insecticide application. The objectives, procedure, safety precautions and role of the family must be explained and the cooperation of the family requested. Any fears or complaints must be dealt with at this time.

o The emphasis of general sanitary education may change depending on community response, the original condition of sanitation within a community, and the economic conditions encountered.

o An intensive two-month campaign should attempt to improve general family hygiene habits and cleanliness, especially in dormitories.
During group meetings, personal protection measures and alternative ways to reduce vector populations will be discussed. These would include moving domestic animals away from the house.

The community's role in surveillance and evaluation of interventions will begin at the same time as the specific intervention. Both the community and individual families will have specific roles.

The community will need to assign certain individuals to such tasks as examining the Maria Sensors, collecting vectors from houses and informing insecticide sprayers when and where to treat. A one-month intensive training program is required.

Household surveillance is necessary if interventions are to succeed. The people must be aware of the significance of surveillance and be willing to commit time to perform the tasks.

6.1.6 Anthropological concepts for community selection

The Community

Is there a spirit of community unity?
Are there community development projects?
Are there community health projects?
Do such divisions as political, religious, or traditional vs. modern health practices exist within the community?
Are there examples of community participation and social meetings? If so, when, where and how frequently do they occur? Who participates?
The Family

- What type of family unit exists?
- Are there social classes?
- Are there different levels of prestige?
- Do men and women have the same influence?
- Is there social exchange within the community?
- Who is the head of the family?
- What are the types of households?
- Where do family members sleep?
- Do children exert an influence?

Educational level

- What is the type and level of formal education in community?
- What is the level of literacy?
- What kind of education is preferred (radio, social drama, school)?
- What is the community’s capacity to study and be motivated towards socio-cultural (behavioral) change?

Culture in the community

- Language
  - Are they bilingual?
  - What languages are spoken?
  - What language is preferred?

- Chagas’ disease
  - conception of disease
  - name given to disease
  - awareness of signs and symptoms
  - importance of disease in family life
  - interest in prevention and control

- Participation in Chagas’ disease control
  - type of work willing to perform
  - days willing to dedicate to the work
- degree of household participation in social and cultural activities
- type of construction materials preferred for house
- cultural and social perceptions about domestic animals
- concept of iatomes in house and relationship to Chagas' disease
- cultural preventions associated with house
- interest in improving house and outbuildings
- concept of disease (fatalistic, taboo, punishment)

Administration of the community

- Type of government
  - Is it traditional?
  - Are there elections?
  - What is the role of unions and civic organizations?

- Celebrations and festivals
- Does government generate community spirit?
- Role of religion in government
  - Catholic
  - Protestant
  - Andean religion

Economic support

- How does the community subsist?
  - regular monthly income
  - agricultural products
  - livestock rearing

- What types of work are performed?
- Are there credit unions and cooperatives in the community?

Health support

- Number and types of health workers in the community
- Presence and role of community health committees
- Linkages, level of cooperation between health workers and health committee
o Extent of second-level MPSSP health services
o Existing PVO or other health projects
  - type of activity
  - results (successes and failures)

Motivation index

o Individual and communal values
o Effort expended on each value
o Pleasure gained in doing a task related to value
o Life expectation in family and individuals

6.2 Vector control

6.2.1 Introduction

Vector control activities in the Tupiza, Tarija and Chuquisaca Departments will follow, when possible, existing program guidelines for each area. The following suggestions and guidelines were devised primarily for the Cochabamba pilot region during the two-year pilot phase of the MPSSP/CCH Chagas' Disease Control Project. Evaluation methods such as insecticide resistance and household infestation tests will be the same in all four pilot regions.

Entomological evaluations will be done in conjunction with epidemiological field staff during initial baseline studies and annual evaluations. Individuals based in the community will be responsible for making more frequent house inspections and either applying insecticide or informing government staff members about the need for intervention.

The National Entomology Laboratory in Cochabamba will serve as the reference laboratory for insecticide susceptibility and evaluation studies as well as for routine taxonomy and T. cruzi determinations within vectors.

Training will be an important part of vector control activities, particularly at the area, sector and community levels. A system for training trainers will be developed.
6.2.2 Insecticide selection and evaluation

Synthetic pyrethroids have been used in some existing house improvement projects. There is concern, however, about using these insecticides in malaria-endemic areas where the government is doing DDT residual spraying to control anopheline mosquitoes. In these areas, the MPSSP Malaria Service has suggested fenitrothion. Yet results in Brazil indicate that synthetic pyrethroids can be used in areas endemic for malaria and Chagas’ disease to control both vectors. It is recommended that laboratory and field tests be done in Cochabamba to verify this observation under Bolivian conditions. An environmental assessment should be done for A.I.D. as soon as possible.

6.2.3 Insecticide susceptibility tests

WHO standarized insecticide susceptibility kits and techniques should be used to perform tests on field-collected or F1 generation *T. infestans* from the four study areas. Similar tests should be done on malaria vectors found in these study areas, especially in Cochabamba. Insecticides tested should include those under consideration for operational use, fenitrothion, deltamethrin and other candidate compounds. Susceptibility tests on triatomes should be performed every two years and anopheline tests annually.

6.2.4 Alternatives for residual applications

Fumigant canisters have not been used in Bolivia but they may be of value in community-based vector control in areas where houses have been improved. The canisters might be field tested in Tupiza or Chuquisaca. If the canisters prove effective, health educators and vector control experts could attempt to work out a community strategy and the logistics of distributing them for more widespread use.
Insecticide-impregnated latex paint, found to be effective against triatomines for two or more years, has been tested in Brazil. This paint has had limited use in Bolivia. Its use needs to be investigated, especially on unmodified walls. The paint could be used on cloth false ceilings and cloth bedroom doors. Additional uses of the paint and strategies for its application are under evaluation in Brazil. Bioanalysis of painted surfaces using triatomines and malaria vectors should be done in the Cochabamba study area.

TDR has a protocol for testing these alternative approaches to residual insecticide applications. Although the length of the studies outlined in the protocol exclude it from practical use in this project, the MPSSP should be encouraged to pursue the research grant. The MPSSP/CCH Chagas’ Disease Control Project could provide administrative, technical, and some economic assistance if the grant were awarded.

6.2.5 Protocol for vector control activities

As much as possible, all vector control activities should be community-based under the supervision of the MPSSP. Initially, all houses and compounds should be sprayed with residual insecticides (inside the houses) using standard malaria procedures but including applications to compound walls and outbuildings. Only insecticides found acceptable in laboratory and field testing should be used.

Initial insecticide applications should be made immediately after house modification. Future insecticide applications may be by residual spraying or alternative strategies. If modified houses have bedroom walls and roofs painted with insecticide-impregnated paint, the bedroom need not be sprayed. Where fumigant canisters are used for domestic triatome control, residual applications will only be made in peridomestic areas.
6.2.6 Methods for evaluating insecticide applications

Bioassays of insecticide treated roof and wall surfaces should be done to determine the residual action of insecticides. Similar bioassays should be done on surfaces receiving a coat of insecticide-impregnated latex paint. Since the composition of walls of houses and outbuildings may be different, bioassays should include all major types of wall surfaces. The standard WHO protocol should be used with both triatomes and mosquitoes.

Indirect methods, such as the María sensor, adhesive tape or posters should be used for community-based household inspections. A system should be established within communities to identify positive houses, confirm positivity, and take appropriate control action.

Direct house searches using the man-hour method should be made immediately after house modification and at six-month intervals thereafter. These searches could be done by community-based individuals or CCH-appointed staff. The latter should be involved in the annual and end-of-the-project evaluations.

6.2.7 Facilities and staff

The MPSSP/CCH Chagas’ Disease Control Project should be involved in training the community, supervising application of residual insecticides, evaluating efficacy of insecticides, distributing insecticides and maintaining the application equipment. Existing facilities within the MPSSP should be used for storing insecticides in the departments.

The National Entomology Laboratory at Cochabamba has space and staff for rearing insects for bioassays. The laboratory could do basic triatome taxonomy and dissection of triatomes for parasitology. In order to become a truly national laboratory, however, the laboratory needs additional staff, commodities and training. Regional laboratories in Chuquisaca, Tarija and
Tupiza might be required. Some entomology staff are assigned to the departmental malaria services. Backup entomological expertise exists at CENETROP, UMSS and IBBA.

The MPSSP has field staff trained in residual insecticide applications (primarily of DDT) in the Chagas' disease-endemic areas. Some additional training in applying other insecticides will be necessary. These staff members may be used for training and supervision of community-based spraying or, under certain circumstances, do the applications themselves.

Workload estimates based upon malaria service activities are:

- Information gathering - 10 houses/person/day
- Entomological searches - 8 houses/person/day
- Insecticide applications - 5 houses/person/day

6.2.8 Research and development

The group recommended a number of basic entomological studies. Although it was recognized that most of these did not fit the objectives of the MPSSP/CCH Chagas' Disease Control Project, such research is considered essential to the overall advancement of Chagas' disease control in Bolivia. Therefore, it is recommended that the project encourage and assist Bolivian scientists in preparing protocols and applying for funding to do this research. (See Annex 4 for the research list.)
6.3 House modification

6.3.1 Introduction

House improvement is a major component in the MPSSP/CCH Chagas' Disease Control Program. It is recognized that this intervention cannot operate in isolation but must be integrated with other aspects of the program. In house improvement, active community participation is the key to success.

Community education and motivation are required to stimulate action to improve health and the quality of life. Experiences in house improvement in Tupiza, Tarija and Chuquisaca are the basis for this section. Organizational structures, operational strategies, and plans of action from these projects have been studied and are used as a starting point for planning the two-year pilot phase of this program (Table 5). To further facilitate planning and execution, it is recommended that CCH staff visit the three areas in February, 1991 to work out methods of collaborating.

The group did not have sufficient time or expertise to discuss the local financial arrangements needed to provide funding for continuous house improvement, but these are essential to the long-term success of the program. It was recognized that some type of rotating fund should be established and it was recommended that the National Committee on Chagas’ Disease Control give creation of this fund high priority on its agenda.

6.3.2 Background

Participants from Tupiza, Tarija and Chuquisaca presented the successes, problems and weak points of specific house improvement projects. These observations are presented in Table 5.
### Table 5
**Summary of House Improvement Efforts in Chuquisaca, Tupiza and Tarija**

#### Chuquisaca

10 comunidades  
420 viviendas  
3 profesores rurales  
mas equipo salud.  
(no hay equipo exclusivo)

<table>
<thead>
<tr>
<th><strong>Fortalezas</strong></th>
<th><strong>Oportunidades</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Prevención)</td>
<td></td>
</tr>
<tr>
<td>Educación</td>
<td>otras instituciones contribuyen también (PROCOSI - CRS)</td>
</tr>
<tr>
<td>Metodología de mejoramiento</td>
<td></td>
</tr>
<tr>
<td>Uso de materiales externos (Calidad del mejoramiento)</td>
<td>La limpieza de muros y tumbados, promueve la sustitución de mecheros.</td>
</tr>
<tr>
<td>Vigilancia vigorosa</td>
<td></td>
</tr>
<tr>
<td>Integración con atención primaria de salud</td>
<td>La demanda de otras comunidades excede la capacidad de respuesta</td>
</tr>
<tr>
<td>La fabricación de tejas se ha tornado en una actividad generadora de ingresos (también carpintería; ataúdes, muebles)</td>
<td>La utilización de estaciones y del calendario agrícola</td>
</tr>
<tr>
<td>Continuidad en el personal clave</td>
<td></td>
</tr>
</tbody>
</table>
Fortalezas

Riesgo y recursos homogéneos
seguimiento
lo. el entorno, 2o. la vivienda

Incentivos y estímulos para
trabajo de campo

Complementación publico-privada

Debilidades

Puertas y ventanas, la
madera no es un recurso
accesible.

Escala limitada

Seguimiento a las viviendas
post-mejoramiento

Presupuesto bajo
($10,000/año)

Carencia de materiales e
insumos (insecticidas,
materiales)

La capacidad de respuesta a
nuevas demandas es limitada.

El apoyo logístico.

Falta de recurso humano de
dedicación exclusive a Chagas
técnicos, rociadores, médicos, etc.)

Amenazas

Dependencia de la
ayuda Británica que
"podría acabarse"

Limitados recursos
económicos de ciertos
grupos dentro de la
comunidad.

Migración (alimentos-
PMA) incentivo a
adecuarse
Tupiza

3 años
14,000 viviendas
21 personas
5 médicos
4 enfermeras
3 consultores

**Fortalezas**

Area urbana y 19 comunidades rurales

Replicabilidad a escala regional
Estrategia de atención primaria salud

Rescate de tecnologías locales y dinámica comunitaria, socialmente aceptadas

La comunidad paga por el rociado rivalida inter comunidades.

Alto impacto en poco tiempo

Con un costo al alcance de la comunidad

Su forma de control mejoramiento (80%) Rociado

**Oportunidades**

Otras comunidades asimilan el modelo en forma espontánea

Liderazgo campesino capacitado que permite extensión a otras áreas

Replicabilidad en otras áreas

La región crea una mística de enfoque y resolución de los problemas.

Congresos campesinos como foro para la divulgación y masificación.
**Fortalezas**

Atención efectiva al peri-domi-cilio potenciando sus posibili-dades de generación de ingresos (actividad económica) diseños tipo de gallineros, conejeras corrales

Se basa en el auto-mejoramiento

Responde, en forma progresiva a niveles sucesivos de riesgo

Personal exclusivo permite escala

El tiempo es corto (3 meses)

Uso efectivo de los alimentos co-mo motivación con un nivel de costo bajo.

**Oportunidades**

La demostración de comunidades "trabajadas"

Demanda amplia de comunidades "ligada" al rociado, ciado, principalmente.
<table>
<thead>
<tr>
<th>Debilidades</th>
<th>Amenazas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitada tecnificación Des. Institucional</td>
<td>Falta de aceptación de de algunas tecnologías y materiales</td>
</tr>
<tr>
<td>Educación y conscientización</td>
<td>Migraciones</td>
</tr>
<tr>
<td>Sólo es una primera etapa de mejoramiento, todavía no se ha llegado a una mejor completa</td>
<td>Los hábitos familiares, sino hay un seguimiento permanente, vuelven a la falta de higiene.</td>
</tr>
<tr>
<td>Tumbados</td>
<td>Las instituciones definen proyectos de un tiempo limitado (2 ó 5 años)</td>
</tr>
<tr>
<td>Materiales utilizados no son permanentes a nivel de perídomilio</td>
<td>Falta de apoyo del nivel central a partir de 1986-87. No se dio la importancia necesaria.</td>
</tr>
<tr>
<td>Condicionamiento a la recepción de alimentos</td>
<td>Falta de coordinación información horizontal-vertical.</td>
</tr>
<tr>
<td>Discontinuidad y falta de permanencia del programa</td>
<td>Fatalismo de los grupos campesinos.</td>
</tr>
<tr>
<td>Fraccionamiento, trabajo en islas (atomización)</td>
<td>Desconocimiento de la relación vinchuca-enfermedad - vivienda.</td>
</tr>
<tr>
<td>No hay control seguridad sobre los recursos, costos operativos, materiales, personal</td>
<td></td>
</tr>
<tr>
<td>Asistencia técnica para ajustar el programa</td>
<td></td>
</tr>
</tbody>
</table>
Tarija

2.200 viviendas
No hay personal

Auxiliar de enfermería
Médicos de Area

<table>
<thead>
<tr>
<th><strong>Fortalezas</strong></th>
<th><strong>Oportunidades</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinculado a Saneamiento Ambiental (Control de vectores)</td>
<td>Responsabilidad de mejoramiento del habitat</td>
</tr>
<tr>
<td></td>
<td>una acción local</td>
</tr>
<tr>
<td>Educación, concientización con personal preparado específicamente para ello (producción propia de material audiovisuales)</td>
<td>Comunidades donde se construyó un sistema de agua, tienen una mayor/ mejor aceptación</td>
</tr>
<tr>
<td></td>
<td>Oferta de incentivos para que la gente no migre en la estación &quot;muerta&quot; y mejore sus viviendas</td>
</tr>
<tr>
<td>Uso de materiales locales</td>
<td></td>
</tr>
<tr>
<td>Recuperación de costos al alcance de la comunidad y resuelto por la comunidad</td>
<td></td>
</tr>
<tr>
<td>2 Períodos de supervisión 52 días</td>
<td></td>
</tr>
<tr>
<td>Coordinación y complementación institucional</td>
<td></td>
</tr>
<tr>
<td>Credibilidad de la comunidad gracias al agua</td>
<td></td>
</tr>
</tbody>
</table>
**Fortalezas**

Sistema radial de acceso a la comunidad (10 minutos a la salud).

Uso efectivo medios comunicación

**Debilidades**

Sólo fue función de la demanda de las comunidades

Excesiva centralización de la Unidad Sanitaria.

No hay continuidad en la supervisión y el seguimiento

No cuenta con personal y fijo y adecuadamente

Coordinación alternativa con Malaria y con Saneamiento.

El uso de materiales dudosos (insecticidas)

Falta de un marco institucional adecuado.

Todavía no hay la decisión política que promovera una acción efectiva (fondos rotativos, insumos).

**Amenazas**

El médico de Distrito todavía no está asumiendo la responsabilidad regionalización descentralización

Migración/Estacionalidad

Chagas no tiene la prioridad ni la compresión adecuada entre funcionarios de gobierno y de las instituciones

Falta el entendimiento vivienda-vinchuca-enfermedad.

Un marco cultural que apecia a la vinchuca como "suerte"
6.3.3 Types of houses in potential study areas

Most houses have a single bedroom, a storage room and a kitchen. The average size of a house is 70 square meters in Chuquisaca and 125 square meters in Tarija and Tupiza. The total area, including compound, corrals and animal shelters, averages 200 to 250 square meters.

Chickens may be found inside houses, roosting in trees or in small chicken coops, which are usually in poor condition. Rabbits and guinea pigs are often in or near the house. Their outside pens are important sites for triatome colonies. Dogs and cats are frequently found in the house.

The houses have few, if any, windows and they are dark, which encourages vector colonization.

In Tarija, Tupiza and Chuquisaca, about 90 percent of the houses are constructed in the following way:

Roofs: mud and straw

Walls: adobe brick, a few with mud- and straw-based plaster (revoque)

Floors: dirt

Tumbados: (false ceiling) cloth of grain sacks (only present in a few houses)

A small percentage of houses have stone walls, which will require additional modification. These stone houses frequently lack windows. In more tropical areas, houses may have palm roofs and walls, or be made of other material such as mud-straw/palm thatch, cane, wood, mud or palms. These will require considerable improvement or reconstruction.
6.3.4 Types of modification

All of these projects rely upon locally available materials for the majority of improvements. Cement, lime or plaster are purchased for some improvements. The principal modifications are as follows:

- **Bedrooms.** Plastering roofs and walls. Cane roofs cause problems because mud and plaster do not adhere to them.

- **Storeroom (depósito).** Covering roofs and walls with mud and paint with lime.

- **Adding windows for light and ventilation.**

- **Kitchens.** Improving ventilation, smoothing walls and roofs, and eliminating cracks.

- **Destroying corrals.** Replacing old chicken coops with ones that are more open and easier to clean. In some instances, roofs of zinc (corrugated sheet metal) or wood are used.

- **Replacing rabbit hutches with new ones that are less likely to become infested.**

- **Smoothing patio walls and eliminating cracks.** About 80 percent of the houses in Tarija do not have enclosed patios. Improving goat corrals.

Although emphasis is placed on using local products, some projects have experimented with other materials, such as cement blocks. A community industry in one village makes roofing tiles for sale in other villages.
6.3.5 Procedure for house modification

- Manufacture adobe bricks, roofing tiles or other materials for construction.
- Gather materials and supplies near the house for actual modification.
- Modify the peri-domestic environment:
  - destroy old corrals, chicken coops and rabbit hutch.e.
  - improve or rebuild corrals;
  - use a mixture of mud and straw (revoque) for animal shelter walls and patios.
- Improve the roof of each house.
  - If roofs of mud and straw are in poor condition, replace them.
  - Strengthen roofs with new cane or tile, or cover them with mud and eliminate cracks in inside surfaces.
- Cover walls of houses.
  - Plaster kitchen, bedroom and storeroom walls with a mixture of mud and straw (revoque).
  - Cover over the revoque (mud and straw) with plaster (yeso) in the bedroom.
- Construct window and door frames as required.
- Construct false ceilings made of cloth or bags (tumbado) under roofs or cover the interior of roofs with a coat of yeso (plaster).
- Improve floors.
  - Floors of bedroom are made of cement.
  - Cover dirt with brick if the production is sufficient.
If possible, construct a latrine.

Place metal, nylon or plastic screens on windows, especially in bedrooms.

Paint entire inside and outside surfaces with lime unless another coating has been used.

6.3.6 Roles in house modification

The community provides:

- all local building materials (adobe, stone, sand, cane, tiles);
- labor;
- wood for door and window frames; and
- economic support for transporting cement and other construction materials.

The program provides:

- non-local building materials (cement, plaster, lime, cloth bags for false ceilings);
- training in house modification for the community;
- outside expertise for construction; and
- window and door screens.

The following is the average amount of non-local material used in house improvement:

- 5-10 bags of cement,
- 6 bags of plaster,
55 bags of lime,

20-25 m² cloth for false ceiling,

1-25 m² of screens.

6.3.7 Criteria for selecting villages for house for modification

The principal criteria are:

- agreement of nearly 100 percent of the community to participate in house improvement;

- positive response of the population to the information/education phase of the program;

- a nearly homogenous population;

- physical access to the village;

- willingness of workers to participate without time limitations; and

- established community with little migration.

Houses within the community are classified into three categories according to their condition.

Type I. Good housing: modern construction with tile or similar roofs, walls plastered without cracks, floor with tile, ceiling of stucco and good hygienic conditions.

Type II. Average housing: roof of tile or other insect-free material, walls partially plastered with few cracks, floor of cement or brick, false ceiling of cloth, and average hygienic conditions.
Type III. Poor housing: poor general construction with roofs of straw, cane or palm; rough walls with cracks, no tumbado, and poor sanitary conditions.

6.3.8 Protocol for house modification activities

The Project Social Boliviano-Británico "Cardenal Maurer" has been adapted as a model for the protocol. Some minor changes have been made based on experience in other areas.

**Phase 1. Selection and initiation**

- Census, mapping and general information gathering;
- Beginning epidemiological/entomological baseline surveys;
- Organizing the community including obtaining information about committees and education; and
- Training of the RPS (Responsables Populares en Salud).

This phase begins three to four months before actual house modification, in February/March 1991.

**Phase 2. House modification**

- Prioritize the community.
- Classify houses.
- Identify actions of intervention.
- Train technical staff and construction experts.
- Identify local materials.
- Train community workers in techniques of house modification.

- Improve peridomestic environment.

- Improve houses.

- Treat domestic and peridomestic environment with insecticide.

This phase depends on agricultural activities and weather. It usually begins in June and ends in September or early October.

**Phase 3. Monitoring and evaluation**

- Continuous community education and motivation directed towards maintaining the condition of the modified house.

- Inspection of house modification and reconstruction as needed.

- Epidemiological/entomological surveillance with community participation (Puesto de Información de Vinchuca: PIV).

**Phase 4. Establishing norms for new house construction and abandoned houses in a study area.**

This is an ongoing activity.
6.3.9 Cost of house modification

The cost per house of materials not paid for by the community is as follows:

<table>
<thead>
<tr>
<th>Proyecto Boliviano-Británico</th>
<th>US$ 93</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proyecto Tarija</td>
<td>US$ 85</td>
</tr>
<tr>
<td>Proyecto Tupiza</td>
<td>US$ 95</td>
</tr>
</tbody>
</table>

These are average costs and do not include labor or local materials. Since a modified house will reduce reliance on continuous insecticide treatment that costs from US$ 36 to $73 every two years, the cost of housing modification should be acceptable to governments contemplating initiation of Chagas’ disease control programs that use insecticides.

6.3.10 Methods of evaluation

Direct supervision

All aspects of house supervision should be undertaken by construction experts, especially plastering of internal and external walls, construction and fitting of windows and doors, and improvement of roofs and false ceilings (tumbado).

Corrals, chicken coops and rabbit pens should be routinely inspected for construction faults and triatome reinfestation. This activity should be the community’s responsibility.

Responsibility for community-based evaluation should be decided by the community. Suggestions include Los Comites Populares de Salud or Los Responsables Populares de Salud (RPS).

Various levels of institutional supervision may be required for the first level: the area doctor, auxiliary nurse and technical team are suggested.
Indirect supervision

- Forms designed for community and institutional level use.
- Reports from the field staff and health committees.
- Entomological evaluations to determine triatome infestations following house modification will be the real test of success.

6.3.11 Field staff requirements

Institutional level

Health teams consisting of a doctor, nurse, insecticide supervisors, technicians for construction, laboratory technicians, epidemiological/entomological evaluators, and health educators are needed for each region and sector.

Community level

The number of individuals needed depends in part on the size of the community. During the house modification phase, most communities will need a roofer, carpenter and wall plasterer, as well as one or more RPS or similar organizational representative.

Staff training and coordination between the MPSSP-CCH and field units at all pilot sites is essential. Financial, technical and training activities must be coordinated.

The Health Units (Unidades Sanitarias) may have to strengthen the sector and area offices in the pilot areas because they have the first level of contact with the community.

Considerable training, motivation and organization will be required at the community level to activate and monitor project interventions.
6.4 Epidemiology

6.4.1. Introduction

Epidemiologic studies of Chagas' disease in Bolivia have been few and limited in scope. The most comprehensive and authoritative work to date is the National Epidemiologic Investigation of Chagas' Disease (Valencia, 1990), a document that has greatly enhanced our understanding of the magnitude of this problem in Bolivia.

Epidemiologic investigations are a crucial component of all stages of disease control programs. During the preparation phase, baseline studies provide valuable insight into the prevalence and distribution of disease or infection, thereby allowing an assessment of the magnitude and public health impact of conditions such as Chagas' disease. This kind of information is particularly useful in guiding subsequent operational research and control efforts by ensuring that appropriate population groups and geographic regions are targeted.

During the "action" or intervention phase of a control program, epidemiologic methods are used to develop surveillance systems to monitor trends in new infections, morbidity and mortality. Surveillance methodology is also useful for detecting acute vector-borne infections, congenitally transmitted infections, and infections due to transfusions with contaminated blood products.

One of the most important applications of epidemiology to control programs occurs during the evaluation phase. During this phase, epidemiologic methods are used to assess the impact, or "success," of various control strategies. By systematically and objectively measuring such parameters as the prevalence of vectors, infection or disease, as well as community acceptance and cost efficiency, epidemiologic evaluation enables program managers to identify problems in control strategies and make appropriate modifications. Moreover, this monitoring helps control program administrators convince others of
the program's success, improving opportunities for continued or expanded technical and financial support from governments and other donors.

This section describes the epidemiologic methods recommended for the MPSSP/CCH Chagas' Disease Control Program. Methods for baseline, mid-program and end-program epidemiologic evaluation (household *T. infestans* infestation and human *T. cruzi* seroprevalence) of the two-year pilot phase will be standardized and used in all pilot sites of the four regions. Periodic seroprevalence surveys will follow the same standardized guidelines in all four areas.

6.4.2 Baseline and follow-up epidemiologic evaluation

The intervention techniques to be used are an integrated combination of approaches that rely heavily on the participation of the whole community rather than specific households or individuals. For each of the four pilot regions, a MPSSP/CCH team will use standardized selection criteria (see sections 4-5) to assist local project leaders (Tupiza, Tarija, Sucre) and MPSSP/CCH field teams (Cochabamba) in selecting four pilot sites within each region. These sites will be established communities of 50 to 100 households each, or if necessary, artificially defined "localities" consisting of groups of smaller communities. Each region should have no more than 400 pilot households, for a maximum total of 1,600 in all regions.

In three of the four pilot sites in each region, the intervention activities selected for the region should begin simultaneously. In the fourth site, specific interventions against Chagas' disease will be delayed so that comparisons with the other three sites can be made. This site, however, will receive other kinds of support, such as potable water and a food program, during the delay of one to two years.

6.4.3 Entomologic evaluation

Surveys for *T. infestans* household infestation levels will be conducted at the onset of the program (baseline) and at one and two years after the program's initiation. These surveys will take
place in all pilot sites in all four regions and will be conducted simultaneously. The man/hour/house method for triatome detection will be used as follows:

A detection team will spend half an hour inside a house (first inspector) and half an hour inspecting surrounding peridomestic structures (second inspector). House inspection will begin in the bedroom and outdoor inspection will begin, in most cases, with the rabbit or guinea pig pen immediately adjacent or attached to the main house. A vector flushing agent may be used to enhance detection and triatomes will be separated according to location captured (within or outside the house). For baseline surveys, a 10 percent sample of captured triatomes will be evaluated for infection with *T. cruzi*. In subsequent surveys, when household infestation levels should be dramatically reduced, all captured triatomes will be examined. All captured triatomes positive for *T. cruzi* parasitemia will be saved for possible future use in isoenzyme or genetic studies.

Entomologic data will be analyzed and results presented as mean and/or median community household infestation levels, densities of infestation (# triatomes/hour/house), and *T. cruzi* infection rates in captured triatomes. In addition to household infestation surveys, systematic inspections for sylvatic triatomes will also be conducted simultaneously. Searches for sylvatic vectors will be accomplished using two people per day per site.

### 6.4.4 Human serologic evaluation

The overall seroprevalence of *T. cruzi* in humans is expected to decline significantly after several years of control efforts, but may not decrease significantly in two years. Data collected during this program will serve as an important baseline for later assessments of the impact of control strategies on human infection. In the short term, targeting specific population groups in the pilot areas will enable program managers to determine incidence trends in newly acquired *T. cruzi* infections. After the initial serosurvey of all individuals residing in the pilot areas, seronegative individuals, people born after the baseline survey and newly arriving immigrants will be screened for antibodies
to *T. cruzi* at 12, 18 and 24 months after the initiation of the program. For all serosurveys, the indirect hemagglutination (IHA) technique for detection of anti-*T. cruzi* antibodies will be used initially; any specimens testing positive by IHA will be confirmed with the indirect immunofluorescence (IFA) technique.

Blood specimens for serologic analysis will be collected by the finger-prick method and stored and transported on Whatman No. 1 filter paper. Results of serologic testing and counselling for seropositive individuals will be made available to the community within one month of specimen collection.

Field teams for serologic and entomologic evaluations will consist of one technician for blood specimen collection, two entomologic inspectors and one supervisor/facilitator.

### 6.4.5 Surveillance

#### Entomologic surveillance

In the pilot regions of Tupiza, Tarija and Sucre, surveillance methodology will attempt to follow guidelines already included in their respective regional control programs. In the Cochabamba pilot sites, four methods of entomologic surveillance will be compared: three passive techniques using Maríia or Gomez-Nuñez sensor boxes, adhesive tape and wall calendars; and one active technique using community members for continuous inspection (see protocol, Annex 9). Surveillance activities will begin one month after the initial application of residual insecticide. Zones noted to be reinfested thereafter will be subject to repeat fumigation by specially trained community-based sprayers or by homeowner use of fumigant canisters.

#### Serologic surveillance

Most details of the serologic surveillance plan were covered in the preceding section on "Human Serologic Evaluation." It should be noted that even though the surveillance plan is not specifically designed to detect acute cases, any individuals who seroconvert from negative to positive will be assessed for
evidence of acute Chagas' disease. If appropriate, they will be referred for further evaluation and treatment to local or regional medical facilities.

6.4.6 Quality control

Quality control of epidemiologic field teams will be conducted on two levels:

1. For each pilot site, the field team leader will be responsible for verifying all forms and specimens before they are submitted to a higher level for processing.

2. In addition, the regional supervisor for the pilot region will return with a special quality control team to do a 10 percent random sample of households in the region. This team will verify infestation levels, confirm that appropriate specimens and information were obtained, and assess whether household members' responses to the epidemiologic field teams were favorable.

Quality control activities should take place within one month of each epidemiologic field evaluation so that any problems identified can be rapidly addressed.

6.4.7 Training

Training for epidemiologic personnel will be accomplished, for the most part, on two levels. Training manuals (see Annex 6) will be produced and regional supervisors (with MPSSP/CCH consultant support) will conduct short classes on field operations for technicians and field team members. These classes should be repeated periodically to reinforce the original curricula and introduce new material, modify older material and discuss problems. On the professional level, consultants from VBC, CDC and universities in Latin America and the United States will provide short courses and lectures as required, but
will emphasize "on the job" or apprenticeship-style training for local physicians, epidemiologists, entomologists, social scientists and administrators.

Active participation by consultants in epidemiologic field activities and research will be a crucial aspect of the training component. Consultants will also be able to assist local scientists in prioritizing research goals, writing protocols, identifying potential funding sources and facilitating interactions with foreign research institutes.

In the Cochabamba pilot region, a third level of training will help project educators teach community members to carry out active surveillance for triatomates.

6.5 Diagnosis of Chagas' disease and serological evaluations

6.5.1. Introduction

The importance of Chagas' disease is increasing in non-endemic areas through:

- transfusion-related transmission;
- transmission to children by infected mothers;
- transmission by organ transplants; and
- laboratory or physician-mediated accidents.

These conditions have brought Chagas' disease into urban areas such as La Paz, where normally it would not be found. These factors are more important in cities close to endemic areas than in areas where the vector is not found. Nevertheless, there is growing concern about transmission through blood transfusions in Canada, the United States and Europe, where large numbers of Latin Americans have migrated.
6.5.2 Diagnosis and Laboratories.

A number of laboratories are doing serology for \textit{T. cruzi} in Bolivia. This information is given in Table 6. Details about specific laboratory procedures are given in Annex 8.

Three categories of laboratories will participate in the program: production laboratories, laboratories for serological diagnosis and epidemiological studies, and laboratories for the control of transmission through blood transfusion.

**Production laboratories** are those that agreed to produce at least standard model reagents, as specified in this workshop. For the serological diagnosis of a \textit{T. cruzi}-infected patient and the offspring of a chagastic mother, antigens produced in Bolivia can be used for the IFA, as well as for the IHA commercial reaction (Polychaco). The CENETROP, CUMETROP and INLASA laboratories are capable of producing antigens for the IFA test.

**Laboratories for serological diagnostic studies and epidemiological studies**: Each type of study requires somewhat different technologies and laboratory expertise. About 600,000 tests may be conducted for epidemiological surveys and surveillance. Reagents produced in Bolivia could be used for IHA (Polychaco) and IFA. All serological procedures will undergo quality control.

For the Chagas-infected patient and offspring of the infected mother two categories of laboratories are described:

a. those that have the technology and trained staff to carry out IFA and IHA tests; and

b. laboratories located in Tupiza, Tarija and Sucre that can carry out micro-strout and IHA.
Laboratories for the control of blood transfusion-related transmission will have personnel fully trained in specific laboratory examinations, as well as in the ethical and legal aspects of disease transmission by transfusion. The minimum available technology will be IHA (Polychaco) and a commercially available ELISA (Abbott Laboratories) for the first four quarters.

6.5.3 Research on congenital or perinatal Chagas’

In compliance with the recommendations issued in 1989 by a group of experts from WHO, the following scheme for diagnosis of the offspring of infected mothers is to be considered:

Pregnant women should undergo a serological examination with IHA plus IFA. The offspring of infected mothers should undergo a parasitological examination by the micro-method using capillaries and micro-titer IHA and IFA serology. Offspring with positive parasitological results may be treated with an anti-parasite medication following standard schemes. Offspring with negative parasitological results will be tested serologically again at six months of age. If the results are higher, the child will be considered infected and treatment will be recommended. If results are negative or show a drastic decrease in serologic titers, the child will be considered not infected. When the health facilities are adequate, parasitological examinations should be repeated weekly for four weeks especially in the presence of: a) low birth weight, b) hepatosplenomegaly and c) prematurity. Chances for the serological and parasitological cure through drug treatment are increased if carried out before the child reaches the age of three.

About 1,000 pregnant women should by surveyed during the first four quarters. One or more Bolivian laboratories should be encouraged to submit protocols for funding and the CCH laboratory coordinator should assist in implementing the study.

The laboratory facilities in Tarija, Sucre, Tupiza and Villazón could sample 500 pregnant women, of which as many as 250 might be infected with Chagas.
Training to carry out this task as well as the detailed work plan to develop the protocols will be finished by the second quarter during the first laboratory training course on controlling transmission by transfusions.

**Estimated Cost:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Serology</td>
<td>5,550</td>
</tr>
<tr>
<td>b) Parasitological Studies</td>
<td>2,500</td>
</tr>
<tr>
<td>c) Treatment</td>
<td>1,500</td>
</tr>
<tr>
<td>d) Surveillance of treatment (including travel)</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>US$ 11,050</strong></td>
</tr>
</tbody>
</table>

Table 6
Chagas’ Laboratories in Bolivia

<table>
<thead>
<tr>
<th>Location</th>
<th>Research</th>
<th>Person Responsible</th>
<th>Production</th>
<th>Available Services in Parasitic Serology</th>
<th>Epidemiological Surveillance</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Paz</td>
<td></td>
<td>Bolanos</td>
<td>Own</td>
<td>Xenodiagnosis, IIF, IHA micro-Strout, ELISA</td>
<td>Yes</td>
<td>Reference National</td>
</tr>
<tr>
<td>INLASA</td>
<td></td>
<td>Alfonso Andrade, R. Strauss</td>
<td>Expanded</td>
<td></td>
<td></td>
<td>Reference National</td>
</tr>
<tr>
<td>Santa Cruz</td>
<td>biology</td>
<td>La Fuente, C.</td>
<td>Own</td>
<td>micro-Strout, IIF, IHA Xenodiagnosis, ELISA</td>
<td>Yes</td>
<td>Reference Regional</td>
</tr>
<tr>
<td>CENETROP</td>
<td>immunology</td>
<td>Rivera, B.</td>
<td>Expanded</td>
<td></td>
<td></td>
<td>Reference Regional</td>
</tr>
<tr>
<td>Cochabamba</td>
<td>biology</td>
<td>Torrico, F.</td>
<td>Own</td>
<td>Xenodiagnosis, IIF, IHA micro-Strout, ELISA</td>
<td>Yes</td>
<td>Reference Regional</td>
</tr>
<tr>
<td>CUMETROP</td>
<td>immunology</td>
<td></td>
<td>Expanded</td>
<td></td>
<td></td>
<td>Reference Regional</td>
</tr>
<tr>
<td>La Paz</td>
<td>biology</td>
<td>Torrico, F.</td>
<td>Own</td>
<td>Xenodiagnosis, IIF, IHA, IFE, ELISA</td>
<td>Yes</td>
<td>Outside Diagonal Network. Inside Recently</td>
</tr>
<tr>
<td>IBBA</td>
<td>immunology</td>
<td>Antezana, G.</td>
<td>Probable Expansion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sucre</td>
<td>No</td>
<td>No</td>
<td>IHA</td>
<td>Yes</td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td>Tarija</td>
<td>No</td>
<td>No</td>
<td>IHA, IIF</td>
<td>Yes</td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td>Tupiza</td>
<td>No</td>
<td>No</td>
<td>IHA, IIF</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
6.5.4 Control of transmission by transfusion

TDR gives research on transmission by transfusion high priority and this program should give it similar priority. This research has two objectives:

a. To reduce the transmission of Chagas' disease by blood transfusions.

b. To improve quality control of blood transfusions at blood banks or hemotherapy facilities.

The current situation in Bolivia is alarming. It is estimated that one of two blood donors is infected. The solution is to conduct serological tests of donors' blood and to have hemotherapy facilities and blood banks available so that blood can be kept for at least 24 hours for treatment with crystal violet.

According to estimates, every year approximately 80,000 Bolivian blood donors give blood that is used for transfusions in the endemic Chagas regions.

The following work should be done during the first eight quarters:

a. A survey of existing blood banks and their capacity throughout Bolivia. The planning group recommended the creation of two blood banks in the region of Tarija (one each in Tarija and Yacuiba). These blood banks would do T. cruzi serology on all blood and have the capacity to store 7,300 blood samples a year. Two other blood banks should be established in the Tupiza region (Tupiza and Villazón) for handling 500 donors' samples annually.

b. The training and updating of personnel from the hemotherapy facilities and blood banks listed in Table 7 will be carried out in two courses offered nationally.
Table 7

Blood Banks and Hemotherapy
Facilities in Bolivia

<table>
<thead>
<tr>
<th>Location</th>
<th>Hospital</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Paz</td>
<td>a) Hospital de Clínicas</td>
<td>Reinforce</td>
</tr>
<tr>
<td></td>
<td>b) Caja Nacional de Seguro</td>
<td>Reinforce</td>
</tr>
<tr>
<td></td>
<td>c) Several private facilities</td>
<td>Reinforce</td>
</tr>
<tr>
<td>Cochabamba</td>
<td>a) Hospital Viedma</td>
<td>Reinforce</td>
</tr>
<tr>
<td></td>
<td>b) Clínica Cardiológica Belga</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Hospital Seton</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Hospital Caja Na. de Seguro</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Other private facilities</td>
<td></td>
</tr>
<tr>
<td>Santa Cruz</td>
<td>a) Hospital San Juan de Dios</td>
<td>Reinforce</td>
</tr>
<tr>
<td></td>
<td>b) Hospital Montero</td>
<td>Organize</td>
</tr>
<tr>
<td></td>
<td>c) Hospital Puerto Suárez</td>
<td>Organize</td>
</tr>
<tr>
<td>Sucre</td>
<td>a) Hospital Santa Bárbara</td>
<td></td>
</tr>
<tr>
<td>Tarija</td>
<td>a) Hospital San Juan de Dios</td>
<td>Reinforce</td>
</tr>
<tr>
<td></td>
<td>b) Hospital Yacuiba</td>
<td>Organize</td>
</tr>
<tr>
<td>Tupiza</td>
<td>a) Hospital Eduardo Eguía</td>
<td>Organize</td>
</tr>
<tr>
<td>Villazon</td>
<td>b) Hospital San Roque</td>
<td>Organize</td>
</tr>
</tbody>
</table>

Cost for the project to control Chagas transmission by transfusion is as follows:

a. Reagents for serological test. Estimating 8,000 donations a year during the two years of the project, a total of 16,000 tests will be performed.
**Costs**

<table>
<thead>
<tr>
<th>Items</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposable materials</td>
<td>21,000</td>
</tr>
<tr>
<td>IHA 1000 kits</td>
<td>70,000</td>
</tr>
<tr>
<td>Production of antigen</td>
<td>91,000</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>21,000</td>
</tr>
</tbody>
</table>

Total US$ 213,000

**6.5.5 Seroepidemiological studies**

In coordination with the epidemiology group, it was agreed that from 20,000 to 30,000 serological studies would be carried out annually for either baseline information or the ensuing evaluation of interventions to control *T. cruzi* transmission. All laboratories listed in Table 6 will be involved.

b. Estimates of 40,000 blood donations a year, which will be treated with crystal violet at four per thousand-weight by volume. The estimated number of treatments will be calculated for the end of the first quarter.

Regional laboratories that should be involved: CENETROP, CUMETROP and INLASA.

Two technical coordination meetings should be scheduled in or near July 1991 and February 1992.

<table>
<thead>
<tr>
<th>Items</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHA: 1 reaction</td>
<td>48,000</td>
</tr>
<tr>
<td>(Polychaco)</td>
<td></td>
</tr>
<tr>
<td>ELISA*: 1 reaction</td>
<td>16,000</td>
</tr>
<tr>
<td>(20% mt)</td>
<td></td>
</tr>
</tbody>
</table>

Total US$ 64,000

* (This reaction is requested in order to evaluate the validity of the positive and negative IHA reaction at a dilution of one).
The cost corresponds to US$ 3.55 for each diagnosis with two titer reactions. In the Bolivian market, the cost varies between 20 and 40 bolivianos for the same work (US$ 1 = 3.36 bolivianos).

6.5.6 Clinical and therapeutical investigation of the Chagas-infected patient.

The group considers that this must constitute a part of the control of Chagas disease. At this time, however, there is not enough information available to elaborate a work plan. There are institutions within Bolivia that have worked in this field: the Cardiology and Clinical Division of IBBA and the Instituto del Tórax in La Paz, CENETROP and the Japanese Hospital in Santa Cruz, and the Clínica Belga in Cochabamba. Since non-vector transmitted Chagas’ disease is apt to increase, it is believed that the scope of the program might be enlarged to include studies on medical care of Chagas’ disease patients.

A survey of existing facilities should be carried out in Bolivia.

6.5.7 Epidemiological field studies

The methods used in obtaining blood samples in the study areas should follow WHO standard procedures.

Procedure:

1. First sterilize the skin of a finger in adults and children, or an infant’s heel. Puncture this area with a sterile lancet, exerting a slight pressure. Wait until a drop of blood flows out. This drop is then absorbed on a 5x5 cm. Whatman No. 1 filter paper so that a concentric circle is formed in each quarter of the filter. A total of four circles must be obtained from each patient. One paper filter will be used for each patient.
2. The paper filter must be completely dried in an area free of insects and kept in a tightly sealed plastic bag containing silicagel granules.

3. The bag or filter paper must contain the following identification data:
   a. Identification number of person.
   b. The person's full name and age.
   c. Location where sample was obtained.
   d. Date.

4. It is recommended that 10 percent of the samples be collected in serokits.
**Summary of the Project for Training of Human Resources**

|------|------|------|------|-----|------|------|------|-------|------|------|

Taking of Blood samples in Tupiza/Villazón

Evaluation of IIF reagent
Laboratories of Blood banks, and epidemiology labs throughout the entire endemic region of Bolivia

Laboratory for detection of Chagas’ in the offspring of infected mothers

* To be completed by Laboratory Coordinator.

1. Drs. W. Strauss and Faustino Torrico will participate in the Congres to be held in Tupiza in March. Training will begin then.
2. External evaluation of Lot I of the IIF reagent, Carlos La Fuente should go to INDIECH - Buenos Aires for a period of two weeks.
3. Same evaluation of Lot II by Dr. Wilma Strauss.
Table 8. Experimental Design - Schedule of Activities for the Control of Non-Vectorial Transmission and Seroepidemiological Studies

<table>
<thead>
<tr>
<th>Activity*</th>
<th>Quarters</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1. Survey of blood banks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Preparation First Course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Technical Coord. Meeting</td>
<td>Jan.</td>
<td>4,000</td>
</tr>
<tr>
<td>4. First National Courses and Manuals (1,000)</td>
<td>March</td>
<td>10,000</td>
</tr>
<tr>
<td>5. Regional Courses (4)</td>
<td>Jan.</td>
<td>3,500</td>
</tr>
<tr>
<td>6. Seroepidemiological Study</td>
<td>April</td>
<td>Dec.</td>
</tr>
<tr>
<td></td>
<td>Sept.</td>
<td>63,400</td>
</tr>
<tr>
<td>7. Congenital Chagas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Trans. Chagas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. In situ* Coordination and Supervision</td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>10. Quality control</td>
<td></td>
<td>168,000</td>
</tr>
</tbody>
</table>

* The Laboratory Coordinator will carry out, by means of a written agreement, in situ activities 1 - 10 in coordination with INLASA and the regional laboratories, and in consultation with the final programming of each activity.
6.6 Flow sheet of combined activities

1. Selection of sites and villages
   a. Confer with staff members of existing projects and health officials in area and visit sites.
   b. Collect all existing information about sites.
   c. Meet with community leaders to determine interest.
   d. Map village.
   e. Conduct KAP study.
   f. Conduct epidemiological/entomological baseline studies, including quality control follow-up within one month of study.

2. Health education - community participation
   a. Determine village structures and organization.
   b. Identify leaders and interest groups.
   c. Begin health education/motivation.

3. Construction and house improvement needs
   a. Classify and measure houses.
   b. Determine local and imported materials needed.
   c. Obtain families’ commitments to work.
   d. Stockpile materials.
   e. Make initial cost estimates.
f. Train construction experts.

g. Identify and train village RPS in Chagas' disease control.

4. House improvement activity

   a. Train villagers in construction techniques.

   b. Educate community about health, sanitation, and the role of good house improvement.

   c. Complete construction (one month per house average).

   d. Conduct residual spray operation.

   e. Conduct serological survey of seronegatives.

   f. Conduct entomological inspection and treatment of positive houses.

   g. Estimate house improvement costs, including labor, local products, imported materials, transport and MPSSP/CCH staff.

   h. Inspect house construction to determine whether norms are satisfied.

5. Evaluation - surveillance

   a. Determine infestation through community participation (indirect method).

   b. Conduct health education for personal protection and house sanitation/upkeep.

   c. Direct house-compound inspection at determined intervals by MPSSP-CCH and follow up with quality control.
d. Conduct epidemiological surveys of seronegatives, newborns and immigrants every six months and follow up with quality control.

e. Arrange house inspection by RPS to determine construction defects and family participation.

f. Cost out surveillance and the entire effort.

g. Attempt a cost-effect and/or cost-benefit analysis by an outside consultant.
7. Staff and Facilities

Permanent professional staff

Epidemiologist: Dr. Fanor Balderrama
Entomologist: Dr. Hernán Bermudez
Computer Specialist: Mr. Juan Carlos Lea Plaza
Laboratory Coordinator: 
Health Educator: 
Epidemiologist: 
Technical Advisor: Dr. Joel Kuritsky

Office staff

Secretary: Mrs. Patricia de la Riva P.
Secretary (temporary): Ms. Patricia Soto
Messenger: Mr. Eduardo Zelaya

Long-term consultants

Epidemiologist: Dr. Ralph T. Bryan, CDC
Entomologist: Dr. Robert J. Tonn, VBC

Facilities

The MPSSP-CCH Chagas’ Disease Project occupies the entire top floor above the CCH office. It consists of six offices, a computer center, library and secretarial/reception office.

Field offices may have to be established at one or more of the study areas or in nearby major cities.
8. Collaborative Arrangements

Multilateral, bilateral, and private volunteer organizations were contacted before the planning meeting. Several had indicated interest in collaborating with the project and many of these took part in the meeting. Some, including PMA, CARE, HABITAT and other USAID programs, have arranged to participate in some parts of the initial operational planning.

Staff members from MPSSP health units in Coroñabamba, Sucre, Tarija and Tupiza also participated in the planning meeting. Meetings were later held at the CCH office to discuss collaborative arrangements at the department level. These discussions are to be followed up in February 1991 during technical staff member’s visits to these departments.

Serological laboratories at INLASA, IBBA, CENETROP and CUMETROP have agreed to cooperate with the project in doing serological tests on samples collected by the epidemiological teams. Financial arrangements for this collaboration are being negotiated. These laboratories also have expressed interest in developing protocols for research on blood transfusion and congenital transmission of Chagas’ disease. Dr. Elsa Segura has offered the services of her laboratory in Argentina to perform quality control checks on serological procedures. This will be pursued by the laboratory coordinator at a later date.

It was agreed that most collaborative arrangements would be made final after the National Committee on Chagas’ disease was established and field operations begun.
9. Targets and Goals

9.1. Duration of the Project

The suggested target date for completion of the pilot project is December 1992. The planning phase will begin with the planning meeting November 26-30, 1990 and will be completed by the end of the first quarter in 1991. High-priority tasks directly related to field demonstration projects will be completed first.

Each activity as outlined below will be performed as specified in the approved plans given in this document. There will be a mid-project evaluation during the fourth quarter that will include planning for an expanded program. Another evaluation will be conducted during the eighth quarter. The success of the demonstration project and interest generated for future donor participation in Chagas' disease control will determine whether a project extension should be requested.

9.2 Chronology of Activities

1st Quarter

1. Establish administration, hire staff, order commodities, develop detailed budget and furnish offices.

2. Establish a National Committee on Chagas' Disease Control.

3. Complete analysis of existing epidemiological data and review existing Chagas' disease control projects.

4. Establish specific intervention strategies (insecticide application, home improvement, education/community development) for Cochabamba pilot sites and prepare manuals describing these strategies.
5. Develop field monitoring (surveillance) methodology for acute cases, seroconverters and triatome infestations for pilot sites.

6. Activate a MPSSP/CCH technical team to assist in problem solving in Tupiza, Tarija, Sucre and to help select pilot sites in all four regions.

7. Introduce activities and preliminary Chagas' disease education to community in Cochabamba sites.

8. Initiate baseline field surveys (including mapping and population census) and field monitoring systems in all pilot sites; complete by end of March.

9. Establish priorities and objectives for research and development.

2nd Quarter

1. Finish collecting baseline data in all pilot sites.

2. Analyze initial epidemiologic, economic, socio-cultural and vector control data.

3. Initiate insecticide susceptibility tests and field tests on alternatives to residual spraying.

4. Develop house improvement technology and construction manuals for Cochabamba pilot sites.

5. Establish a center to train rural professors of health, health promoters and construction experts for the Cochabamba pilot region (with possible extension to Tarija training center). Prepare curricula and didactic materials.

6. Initiate planning and education with community leaders to begin house modification and fumigation activities in the Cochabamba region.
7. Present preliminary data to the National Committee on Chagas’ Disease Control and potential donors.

8. Request research proposals on blood transfusion and congenital transmission, insecticide use, construction methods and building materials, and serologic diagnosis. Make the final contractual agreements on serology studies and other research proposals.

3rd Quarter

1. Refine field activities as required.

2. Continue analysis of baseline and other project data.

3. Initiate intervention activities (according to existing program guidelines) in Tupiza, Tarija and Sucre pilot sites.

4. Begin house modification activities in Cochabamba pilot sites.

5. Begin health/sanitation education in Cochabamba pilot sites.

6. Develop community-based insecticide application activity and a community-directed surveillance and reporting system for Cochabamba pilot sites in conjunction with number 4 above.

7. Evaluate activities of the Cochabamba rural professor training center, and assess curricula and didactic material.

8. Present progress report to the National Committee on Chagas’ Disease Control and potential donors.
4th Quarter

1. Review initially contracted research projects.

2. Continue health education phase in Cochabamba pilot sites.

3. Continue intervention strategies in Tupiza, Tarija and Sucre according to respective program guidelines.

4. Implement insecticide application (residual spraying of houses) or use of alternative methods of triatome control in improved houses in the Cochabamba sites.

5. Continue house/compound improvement through October and review progress in Cochabamba.

6. Investigate systems of providing interest-free or low interest loans for rural house improvement in Cochabamba.

7. Present a progress report to the National Committee on Chagas’ Disease Control and potential donors. Begin planning expanded program beyond the two-year pilot phase.


5th Quarter

1. Review contracted research projects, e.g. the quarterly progress reports.

2. Continue all activities at pilot sites; correct problems and modify as necessary.

3. Conduct first follow-up serology survey of seronegative individuals, newborns and immigrants in all pilot sites in January. Repeat household survey for *T. infestans*
infestation at all sites via a standardized evaluation for all pilot sites in all four regions. Do quality control follow-up.

4. Write a first-year progress report, formulate year-end conclusions based on data analysis, and incorporate changes recommended by the external evaluation team.

5. Continue planning the expanded program.

6. Present a progress report to the National Committee on Chagas' Disease Control and potential donors.

6th Quarter

1. Review contracted research projects, e.g. the quarterly progress report.

2. Continue education and surveillance activities at pilot sites; in June, continue house modification activities.

3. Conduct second six-month follow-up serosurvey of seronegative individuals, newborns and immigrants in all pilot sites.

4. Review and modify or expand plans for prenatal and neonatal screening for Chagas' disease and write protocol and recommended strategy. Select institute(s) for studies.

5. Develop, modify or expand protocols for evaluating Chagas' disease-related childhood and maternal morbidity and mortality. Select institute(s) for studies.

6. Develop, modify or expand strategies for evaluating the public-health impact of transfusion-related Chagas' disease in major urban areas.

7. Present a progress report to the National Committee on Chagas' Disease Control and potential donors.
8. Meet to discuss expanded project and plan for end-of-project meeting.

7th Quarter

1. Review contracted research information, e.g. the quarterly report.

2. Contract additional research about prenatal and neonatal screening for Chagas’ disease; evaluate Chagas' Disease-related childhood and maternal morbidity and mortality; evaluate the public-health impact of transfusion-related Chagas’ disease in major urban areas.

3. Continue all education and surveillance activities at pilot sites; continue house improvement activities through October.

4. Develop a list of priority areas for future research and development and assist local scientists in efforts to initiate such studies. Develop funding sources and collaborators.

5. Distribute report on expanded project. Continue plan for end-of-project meeting.

6. Present a progress report to the National Committee on Chagas’ Disease Control. Meet with potential donors.

7. Implement evaluation and reassess all aspects of project for final meeting and report.

8th Quarter

1. Review contracted research projects, e.g. quarterly progress report.

2. Continue education and surveillance activities at pilot sites.
3. Conduct final follow-up serosurvey of seronegative individuals, newborns and immigrants in all pilot sites in December and January.

4. Conduct end-of-project household survey for triatome infestation at all sites in December and January.

5. Complete internal evaluation of project.

6. Complete external evaluation of project.

7. Convene the final meeting of the project to report findings, make recommendation and plan for long-term activities.

9.3 Criteria for evaluating the MPSSP/CCH Chagas’ Disease Control Project

9.3.1 Frequency

There should be two general evaluations during the pilot phase of the Chagas’ Disease Program. The first should occur during the fourth quarter, the second during the eighth quarter. Intermediate evaluations will be made by requesting comments on the quarterly progress reports from the National Committee on Chagas’ Disease Control, MPSSP, CDC, VBC and USAID.

9.3.2 Membership of the evaluation teams

The two general evaluation teams should include representation from MPSSP, CCH, CDC, VBC, USAID/La Paz and the National Committee on Chagas’ Disease Control. Experts in various aspects of the control project from Bolivia or other countries may serve as consultants to evaluate specific parts of the project. The evaluation teams should prepare a report that includes conclusions and recommendations about the project as well as suggestions for additional research. The teams should use this report for guidance.
9.3.3 Guidelines for evaluation

The following guidelines are suggested for the evaluation of progress made by the Chagas’ Disease Control Project.

a. Has the project followed the plan of action proposed at the November 1990 planning meeting? Is the plan of action relevant?

b. Has the project met the goals and targets set forth in the report of the planning meeting?

c. Is the project staff adequate? Does staff members’ work fit their job descriptions?

d. Are resources sufficient to achieve the stated objectives?

e. Does the project have appropriate objectives and are priorities correctly assigned? Are there alternatives?

f. Is each activity properly coordinated with the others?

g. Assess the adequacy, progress, efficiency, effectiveness and impact of each activity separately; make an assessment of the project as a whole.

h. List and comment on any unfulfilled needs.

i. What are the relationships with other agencies working in the same project sites? How can such relationships be improved?

j. Is the information provided in quarterly reports adequate and accurate? Is progress evaluation appropriately linked to action?

k. Is the National Committee on Chagas’ Disease Control functioning adequately and within the scope of work outlined?
1. Has adequate progress been made in obtaining commitments from other donors?

m. Provide recommendations to improve administrative and technical functions to the project.

n. Assess research in progress and provide suggestions for future research.
10. Projected Costs and Funding Sources

Budget Estimates

<table>
<thead>
<tr>
<th>Community Participation and Health Education</th>
<th>US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of radio spots and use. 4 x US$ 2,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Production of 4 10-minute audiovisual aids</td>
<td>8,000</td>
</tr>
<tr>
<td>Design, production and distribution of 4 posters at US$ 1,500 each</td>
<td>6,000</td>
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<tr>
<td>4 sets of pictures and slides</td>
<td>1,000</td>
</tr>
<tr>
<td>Design, production and distribution of brochures</td>
<td>1,600</td>
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<tr>
<td>Education manuais for schools</td>
<td>4,000</td>
</tr>
<tr>
<td>Manual for house improvement construction/maintenance</td>
<td>5,000</td>
</tr>
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<td>Instructive materials for sanitation, insecticide use and personal protection</td>
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<td>Script and production of a radio drama</td>
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<tr>
<td>Total US$</td>
<td>49,200</td>
</tr>
</tbody>
</table>

Laboratory - Serology and Investigation

| Training, standardization, quality control for blood transfusion - blood bank studies | 93,000 |
| Serological tests for blood transfusions and blood bank studies | 64,000 |
| Congenital studies and treatment of infected infants | 10,500 |
Epidemiological-baseline and follow-up serological studies for program evaluation 213,000
Field work related to epidemiological studies 11,300
Total US$ 391,850

Field Epidemiology

Labor for first four months (selection of areas, training and obtaining baselines) 16,100
Serological examinations based on 23,000 HAI tests at US$ 1.00 per test and 5,500 IFA tests at US$ 2.55 per test 37,025
Total US$ 53,125

House Modification

Materials and transport not furnished by community 1600 houses x US$ 100 160,000
Labor (roofer, carpenter and plasterer) 16,000
Transport and evaluation 4,000
Total US$ 180,000
Contracts for Study Areas

Tupiza (100,000 yr) 200,000
Tarija (100,000 yr) 200,000
Chuquisaca (100,000 yr) 200,000
Cochabamba (200,000 yr) including field research 400,000
Total US$ 1,000,000

Entomology

Commodities for field and laboratory studies, including insecticides 100,000
Insectary management and susceptibility testing 6,000
Field bioassays and evaluation of alternative insecticides 12,000
Total US$ 118,000

Contingency for technical costs 10% of total 179,208
Total Technical Costs US$ 1,971,283

Not included in the estimate:

Three vehicles and their maintenance
Computers, printers, office furniture and supplies
Office space rental and maintenance
Consultants (national and international)
National Committee on Chagas’ disease
Staff salaries and benefits
11. National Committee on Chagas’ Disease Control

11.1 Introduction and objectives

Chagas’ disease control is one component in a number of rural development and health projects in Bolivia. Some research institutes and laboratories have been investigating various aspects of Chagas’ disease and performing diagnostic services. The MPSSP is involved with Chagas’ disease control activities in some departments. Because of the many ongoing activities in Bolivia, a national committee has been proposed to promote further activities and to coordinate the present ones.

The committee will have the following duties:

- Coordinating Chagas’ disease control, laboratory diagnosis, and investigative activities within Bolivia.
- Evaluating projects on Chagas’ disease control in Bolivia and establishing norms for future projects to direct their activities towards standard goals.
- Promoting and approving new Chagas’ disease control projects and investigations; assisting in obtaining funding for these activities.
- Securing additional funding to ensure that the MPSSP-CCH Chagas’ Disease Project continues beyond the pilot phase.

11.2 Committee membership

- MPSSP: One or two members, one of whom will be designated chairperson of the committee. It is suggested that the Director General of Health be the initial chairperson.
- Chief of Health Programs for USAID/La Paz
o Representative from P.L.-480

o Representative from PAHO

o Representative from PMA

o Representative from UNICEF

o Representatives from one or more Private Volunteer Organizations working on Chagas’ disease

o Representative from other ministries as suggested by the MPSSP

o Representatives from bilateral agencies with interest in Chagas’ disease control/house improvement.

To expedite the formation and work of the committee, it is suggested that the MPSSP issue an official decree. The committee may have to meet every two weeks initially but once established, monthly meetings may be sufficient.

11.3 Technical subcommittee

The technical subcommittee will give technical support to the national Committee. Its specific duties are to:

o assist in the technical evaluation of existing and proposed projects;

o provide any technical norms required by the MPSSP or the National Committee;

o provide technical assistance to any organization preparing Chagas’ disease control and rural house improvement activities;

o help organize and monitor research and field projects associated with the MPSSP-CCH Chagas’ Disease Project;
promote and review research in various aspects of Chagas’ disease prevention and control; and

help develop appropriate manuals in house modification and other program activities, as well as educational and communication material required by agencies interested in Chagas’ disease control.

11.4 Technical subcommittee membership

Subcommittee members should include representatives from:

- MPSSP: one or two members, one of whom would be the Director of the National Division of Epidemiology
- USAID/CCH
- PAHO
- UNICEF
- P.L. 480
- PMA
- HABITAT
- IBBA
- CENETROP
- CUMETROP
- one or two experts from PVOs.

The subcommittee will meet at regularly scheduled intervals, and as needed, ad hoc.
11.5 Secretariat

The Group recommended that CCH employ a full-time person to serve as secretary to the national committee and the technical Subcommittee. With the assistance of the committee chairperson, the Secretariat will be responsible for preparing an agenda and informing members of the time and place of the meeting. The secretary and chairperson of the technical subcommittee should visit research institutions sponsored by the MPSSP-CCH and the MPSSP-CCH field projects periodically, and give members progress reports.

The Secretariat should work with the professional staff of MPSSP-CCH Chagas' disease to produce quarterly reports. These reports should be circulated to committee and subcommittee members, and comments should be returned to the MPSSP-CCH Chagas' Disease Project in writing. The Secretariat must maintain contact with bilateral, multilateral and private volunteer organizations to promote technical and financial support for the national committee and MPSSP-CCH activities against Chagas' disease. To further this support, the Secretariat should prepare a monthly newsletter to keep all interested parties informed.

11.6 Budget

An initial budget of US$ 50,000 will be allocated by the MPSSP-CCH Chagas' Disease Project for the National Committee, Technical Subcommittee and Secretariat.
12. Communications, Information Exchange and Training

12.1 Literature reference center

A library will be established at CCH for Bolivian publications and unpublished documents. Arrangements have been made with the Vector Biology and Control Project of Arlington, Virginia, to furnish a quarterly printout of MEDLINE references and reprints of articles deemed of value to the program. TDR and scientists from other countries are being contacted to contribute reprints to the center. This material will be available to investigators of Chagas' disease in Bolivia.

12.2 Data management

Field reports and other forms will be developed by technical staff in conjunction with staff members from the computer center. Some field testing will be done before these forms are used at the actual study sites.

Data collected from field and laboratory sites will be systematically channeled to the Program offices in La Paz. Raw data (field forms, laboratory results) should be hand-carried by professional staff from field offices to La Paz. As field computers become available and individuals at regional sites are trained in data entry, computerized data from the field may be transferred to La Paz by modems or on diskettes. All data management and analysis will be centralized.

Most data analysis and processing will be accomplished with the software packages EPI INFO-5 and D-BASE III Plus; when necessary, SAS may also be used. CCH professional statistical personnel will perform the analysis. Assistance from CDC statisticians will be readily available if it is required.
12.3 Training

Each component of the project will undertake internal staff training as well as training of field and laboratory staff assigned to the project. Manuals on various interventions will be produced with the assistance of experts in education and community participation.

In some instances, individuals from the community may be brought to centers for such specialized training as carpentry, roofing and plastering in the house modification component.

Community health personnel and rural teachers will be given training about Chagas' disease and its control, as well as the specific functions they may perform for the project within the community.

A laboratory coordinator will be selected to visit all serological laboratories involved with project activities to standardize methodology. The coordinator will organize two training courses during the life of the project.
13. Literature cited


14. Bibliografía

1. Centro de Referencias

Se establecerá una bibliografía de todas las publicaciones bolivianas. Una lista de estas referencias será enviada a todos los investigadores de la enfermedad de Chagas conocidos en el país. Se han hecho arreglos con el "Vector Biology and Control Project" de Arlington, Virginia para obtener trimestralmente un impreso de referencias MEDLINE, así como reimpresos completos de artículos considerados de interés para el componente. Estamos poniéndonos en contacto con TDR y científicos de otros países para que contribuyan al centro.

2. Literatura citada en este documento *

   a. WHO Chagas’ Disease, Frecuencia y Distribución geográfica. Publicación Epidemiológica Semanal. 24 Agosto 1990


* (Ver Anexo 3 para la lista de los papeles de trabajo)
ANNEX 1. AGENDA OF MEETINGS

A. INAUGURATION

PROGRAMA:

Análisis del Problema de Chagas, Dr. Roberto Vargas, Director Nacional de Epidemiología

Palabras del Director de USAID, Sr. Carl Leonard

Palabras del Sub Director de CDC (Centros de Control de Enfermedades), Dr. Walter Dowdle

Palabras del Embajador de los Estados Unidos de Norteamérica, Excmo. Sr. Robert Gelbard

Palabras del Señor Ministro de Previsión Social, Salud Pública, Dr. Mario Paz Zamora

Palabras del Excmo. Sr. Presidente de la República, Lic. Jaime Paz Zamora

Hrs. 11:30 Vino de Honor
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<td>Inauguración</td>
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<td>Explicación del Proyecto CCH</td>
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<td>Explicación de Componente Chagas</td>
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<td>2. Mejoramiento de la vivienda</td>
<td>Dr. Velasco</td>
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<td>3. Control de vectores</td>
<td>Dra. Vance</td>
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<td>4. Epidemiología</td>
<td>Dr. Bermudez</td>
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<td>5. Laboratorio</td>
<td>Dra. Balderrama</td>
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<td>6. Coordinación Inteinstitucional</td>
<td>Dra. Segura</td>
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<td>Dr. Kuritsky</td>
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<td>Reunión de los Moderadores (CCH)</td>
<td>Dr. Valencia</td>
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<td>Dr. Vargas</td>
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<td>Retorno al hotel</td>
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<td>Dr. M. Paz Zamora-MPSSP</td>
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<td>Reunión Final de los Moderadores</td>
<td>Dr. Valencia</td>
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La reunión del día 30 será en las oficinas de CCH

NOTA: El transporte de los Hoteles "El Dorado" y Plaza al Club de Golf será a horas 07:45 y el retorno a hrs. 19:00.
ANNEX C. LIST OF PARTICIPANTS OF TECHNICAL MEETING

TALLER DE ARRANQUE

Proyecto de Salud Infantil y Comunitaria
Componente Chagas

LA Paz 26 - 30 Nov. de 1990

Grupos de Trabajo

1. Participación de Comunidad y Educación de Salud

<table>
<thead>
<tr>
<th>Participante</th>
<th>Organización</th>
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<tr>
<td>Dr. Jorge Velasco</td>
<td>CCH</td>
</tr>
<tr>
<td>Sr. Joseph Bastien</td>
<td>VBC-USA</td>
</tr>
<tr>
<td>Dr. Silverio Gonzalez-Tellez</td>
<td>VBC-VEN</td>
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<tr>
<td>Ms Rita Fairbanks</td>
<td>CCH</td>
</tr>
<tr>
<td>Dra. Magaly Lannier</td>
<td>US-CBBA</td>
</tr>
<tr>
<td>Sr. Eduardo Infante</td>
<td>CARITAS</td>
</tr>
<tr>
<td>Sr. Fernando Díaz Romero</td>
<td>PROCOSI</td>
</tr>
<tr>
<td>Sr. Chris Roezel</td>
<td>CARE</td>
</tr>
<tr>
<td>Ing. Raúl Eduardo Gonzalez</td>
<td>PMA</td>
</tr>
<tr>
<td>Lic. Rosario Velásquez</td>
<td>MPSSP-Rec.Humanos</td>
</tr>
<tr>
<td>Ms Sandra Wilcox</td>
<td>USAID</td>
</tr>
<tr>
<td>Ms Michelle Fryer</td>
<td>USAID</td>
</tr>
<tr>
<td>Lic. Enrique Lavadenz</td>
<td>CARITAS</td>
</tr>
<tr>
<td>Sr. Dino Siervo</td>
<td>USAID</td>
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2. Mejoramiento de Vivienda

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<tr>
<td>Dra. Irene Vance</td>
<td>Habitat</td>
</tr>
<tr>
<td>Ing. Mathew Cheney</td>
<td>USAID</td>
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<tr>
<td>Dr. Julio Pizarro</td>
<td>US-Tarija</td>
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<tr>
<td>Lic. Provan Agrawal</td>
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<tr>
<td>Ing. Pedro Aliaga Doria Medina</td>
<td>MPSSP/PSA</td>
</tr>
<tr>
<td>Dr. Daniel Rivas</td>
<td>PROY. BRIT.</td>
</tr>
<tr>
<td>Dr. Robert Tonn</td>
<td>VBC - USA.</td>
</tr>
<tr>
<td>Dr. Roberto Marquez</td>
<td>US - Tarija</td>
</tr>
<tr>
<td>Mr. Mahlon Barash</td>
<td>USAID</td>
</tr>
<tr>
<td>Arq. Rafael Indaburu</td>
<td>USAID</td>
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3. Control de Vectores y Evaluación

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<tr>
<td>Dr. Hernán Bermudez</td>
<td>CCH-BOL</td>
</tr>
<tr>
<td>Dr. Mario Villaígrá</td>
<td>MPSSP</td>
</tr>
<tr>
<td>Dr. Andrew Arata</td>
<td>VBC-USA</td>
</tr>
<tr>
<td>Mr. Abraham Jemio</td>
<td>MPSSP</td>
</tr>
<tr>
<td>Dr. Jean - Pierre Dujardin</td>
<td>IMT - Belgica</td>
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<tr>
<td>Dr. Philip Marsden</td>
<td>VBC - Brasil</td>
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1. **Epidemiología**

Dr. Fanor Balderrama  
Dr. Ralph Bryan  
Dr. Rene Mollinedo  
Dr. Germán Guillen  
Dr. Ángel Valencia  
Sr. Juan Carlos Lea Plaza  
Dr. Luis Morales  
Dr. Julio Alfred

2. **Laboratorios / Diagnóstico**

Sra. Elsa Segura  
Dr. Benjamin Ribera  
Dr. Mario Toro Wayar  
Dr. Faustino Torrico  
Dr. Octavio Aparicio O.  
Sra. Wilma Strauss  
Dr. Carlos La Fuente  
Dr. René Angles  
Dr. Alfonso Bolaños  
Dr. Ronald Andrade  
Prof. Dr. Ives Carlier  
Dra. Roxana Carrasco L.

3. **Comité Coordinador Nacional**

Dr. Joel Kuritsky  
Dr. Jack Antelo  
Dr. René Zumaran  
Sr. Charles Llewellyn  
Dr. Jorge Crisostomo  
Dr. Roberto Vargas  
Dr. Paul Hartenberger

CCH-BOL  
CDC  
MPSSP-Epidemiología  
FIDA  
CCH  
UMSS  
US-Tupiza  
VBC-ARGENTINA  
CENETROP  
CIDECH  
UMSS  
IBBA  
INLASA  
CENETROP  
INLASA  
INLASA  
Univ. Bruselas  
IBBA  
CCH  
MPSSP  
PL-480  
USAID  
CARITAS  
MPSSP  
USAID
All Sections

TDR/CHA/EPD/PROTO/86.3. Report of a meeting on the feasibility of analytical epidemiological studies on Chagas' disease:

Guidelines for a standard protocol.

TDR/SER-CHA/METEPET/80.3 Workshop on epidemiological, social and future methods of Chagas' disease control.

TDR/CHA/URU/89.3 Protocolo estandar para el ensayo de nuevas estrategias de control de vectores de la enfermedad Chagas.


House Modification


Schofield, C.J. et al., The role of house design in limiting vector-borne disease (Chapter II, Appropriate Technology in Vector Control) pp. 188 - 212. 1990.
Socio - Cultural


Vector Control


TDR/CHA/PAN/ 87.3 Report of a meeting on research needs in the field of Chagas disease vector control.

Epidemiology


Laboratories


Frasch, A.C.C. and Reyes, M.B., Diagnosis of Chagas' disease using recombinant DNA technology.


ANNEX 4. PRIORITIES FOR RESEARCH AND POTENTIAL INSTITUTIONS WITH EXPERTISE (institutions proposed for implementation and/or reference)

1. The TDR protocol for the study of new strategies of control of the vectors of Chagas' disease.
   a) Department of Epidemiology
      MPSSP: La Paz

2. Insecticide susceptibility tests, bioassays, and entomology.
   a) National Entomology Laboratory
      Department of Epidemiology
      MPSSP: Cochabamba

3. Role of sylvatic T. infestans and other sylvatic triatomines in the transmission of T. cruzi to humans (distribution natural habitats, population movement and host preference studies).
   a) Centro Universitario de Medicina Tropical (CUMT)
      Universidad Mayor de San Simon (UMSS)
      Facultad de Medicina
      Cochabamba

4. Genetical studies on domestic - peridomestic and sylvatic T. infestans
   a) IBBA - La Paz
   b) UMSS - Cochabamba

5. Role of human migration in the transmission of Chagas.
   a) CUMT/UMSS - Cochabamba

6. Development of practical, inexpensive T. cruzi antigen and/or anti-T. cruzi antibody assays that utilize capillary tube or filter paper blood specimens or urine are essential as are assays capable of differentiating acute and chronic T. cruzi infections.
Development of safer, more effective anti-trypanosoma medications, particularly for chronic *T. cruzi* infections.

Medical School of National University of Cordoba
First Service of Clinical Medicine
Cordoba, Argentina.
8. Alternatives to gentian violet for the treatment of blood
donates for transfusion should be developed: potential agents
must be inexpensive, readily available or producable, rapid
acting, non-toxic.
   a) University of Texas Medical Branch - Galveston, TX, USA.

3. Determination of isotypes of antibodies to T. cruzi in acute
Chagas' patients and seropositive infants
   a) IBBA - La Paz
   b) INLASA - La Paz
   c) CENETROP - Santa Cruz
   d) UMSS - Cochabamba

10. Prenatal/neonatal screening for Chagas' disease and evaluation
    of Chagas' related maternal and childhood morbidity and
    mortality.
    a) CENETROP - Santa Cruz
    b) CUMT/UMSS - Cochabamba.
    c) DPD/CID/CDC - Atlanta, Georgia, USA.

11. Evaluation of the public health impact of transfusion -
    related Chagas' disease in major urban centers in both Chagas
    endemic and non-endemic regions.
    a) IBBA - La Paz
    b) CENETROP - Santa Cruz
    c) CUMT/UMSS - Cochabamba
    d) Centro de Investigaciones y Diagnóstico de la
       Enfermedad de Chagas - Sucre
    e) DPD/CID/CDC
       Atlanta, USA
12. Evaluation of the potential association between household triatome infestation and anemia in children.
   a) CUMT/UMSS - Cochabamba
   b) DPD/CID/CDC
      Atlanta, USA

13. Studies of human immunologic responses to infection with T. cruzi with emphasis on the evolution of infection and etiologic basis for T. cruzi-associated pathology.
   a) CUMT/UMSS - Cochabamba
   b) Albert Einstein School of Medicine - New York, USA
   c) LPD/NIAID/NIH - Bethesda, MD, USA.
   d) Atlanta, USA
      DPD/CID/CDC

14. Establishment of surveillance systems for acute and congenital T. cruzi infections in rural health posts as well as regional medical centers in order to assess incidence and promote interaction between Chagas' control programs and the medical community.
   a) UMSS - Cochabamba
   b) CENETROP - Santa Cruz
   c) Unidad Sanitaria: Cochabamba, Tarija, Tupiza, Chuquisaca

15. Ecological studies of peridomestic - domestic T. infestans, including spatial distribution, population dynamics, population movement, and evaluation of surveillance methods
   a) UMSS - Cochabamba
   b) Unidad Sanitaria: Cochabamba, Tarija, Tupiza, Chuquisaca

16. Economic accessibility and financial conditions of rural communities of the study areas
17. Analysis of incentives and stimuli as related to house improvement

18. Alternatives for community financial support in the house improvement

19. Improvement of infrastructure, walls, roofs and patios in house improvement

* All study sites
ANNEX 5. LIST OF POSSIBLE CONSULTANTS BY DISCIPLINE (not exclusive)

1. Vector Control and Medical Entomology

a) Dr. A.M. Oliveira Filho
Nucleo de Pesquisas de productos naturais
Universidad Federal de Rio de Janeiro
CC 5 Bloco H
CEP 21941, Rio de Janeiro, Brazil

b) Dr. E.N. Zerba
Centro de Investigaciones de plagas e insecticidas
Zufriategui 4380, Villa Martelli
Buenos Aires, 1603 Argentina

c) Dr. J. Cichero
Servicio Nacional de Chagas
9 de Julio 356
Cordoba 5000 Argentina

d) Dr. M. Nelson
OPS
Apartado 7260
Panama, 5, Panama

e) Dr. J.C. Pinto Dias
Bello Horizonte, Brazil

f) Dr. Rodolfo Carcavallo
Francisco Beiro 3390
1419 Buenos Aires, Argentina
II. Socio - Cultural and Economical Aspects

a) Dr. Roberto Briceno - Leon
Laboratorio de Investigaciones Sociales
Apartado 47795
Caracas 1040 - A. Venezuela

b) Dr. Joseph Bastien
609 Charles Cr.
Arlington, Texas 76013

c) Dr. Silverio Gonzalez-Tellez
Universidad Central de Venezuela
Caracas, Venezuela

d) Drs. Donald & Diana Sawyer
Brazil

III. House Modification

a) Dr. J.C. Pinto Dias
See above

b) Dr. C.J. Schofield
TDR
World Health Organization
Geneva, Switzerland

c) Dr. Philip Marsden
Universidad Federal de Brasilia
Brasilia, Brazil
4. Epidemiology

a) Dr. Rafael Cedillas
MSCI/San Salvador
San Salvador, El Salvador

b) Dr. R. Sifontes - Ferrer
Ministerio de Sanidad y Asistencia Social
Maracay, Venezuela

c) Dr. O. E. Souza
Faculty of Medicine
University of Panama
Panama, Panama

5. Laboratories and Diagnosis

a) Dr. E. Seguro
INDIECH Dr. Mario Fatalia Chaben
Avenida Paseo Colon 568 - 70 piso
1063 Buenos Aires, Argentina

b) Dr. Murray Wittner
Albert Einstein School of Medicine
New York, New York USA

c) Dr. Louis Von Kirchoff
University of Iowa
Iowa City, Ioea USA
d) Dr. E. Chiari
Instituto de Ciencias Biológicas - UFMG
Av. Antonio Carlos 8627
Caixa Postal 2486
31270 Belo Horizonte. M.G. Brazil
Tel (031) 441.6909
Telex (031) 2308 CIFMA

e) Dr. A.C.C. Frasch
Instituto de Investigaciones Bioquímicas
" Fundación Campomar "
Antonio Machado 1521
Buenos Aires
CF 1405 Argentina
Telf: 54.1.881916 FAX: 54.1.865.2246

f) Dr. Franco da Silveira
Escola Paulista de Medicina
Depto de micro, Imano e Parasitologia
Rua Butucatun 862, andar 6
Sao Paulo  SP CEP 04023
Brazil
Telf: 572-6033 ext. 243
Telex: (011) 36977 FAX: 571.1095

g) Dr. Samuel Goldenberg
Fundacao Oswaldo Cruz
Depto. Bioquímica e Biologia Molecular
Avenida Brasil 4356
Rio de Janeiro 21040
Brazil
Telf: 55-21-290-7549
Telex: 2134302 FAX: 55-21-590-3495
h) Dr. Lemone Yielding
University of Texas Medical Branch
Galveston, TX 77550
USA
ANNEX e. LIST OF MANUALS AND DOCUMENTS TO BE PREPARED

1. Entomological Field Manual for Chagas' Disease
2. Field Supervisors Manual for Chagas' Disease
3. Epidemiological Field Manual for Chagas' Disease
4. Chagas' Disease Prevention and Control for the Community Health Worker
5. Laboratory and Insectary Procedure in Chagas' Disease Vector Entomology
8. Chagas' Disease Instruction in Rural Primary Schools
9. Instructions for Use of Field and Laboratory Forms in the Program
10. Manual for Epidemiological Quality Control Field Teams (Checklist)
ANNEX 7. PRELIMINARY LIST OF FIRST LEVEL FORMS FOR THE PROGRAM

1. KAP Study: Initial and Follow-up
2. Social Acceptability of Interventions
3. House Visitation Card
4. General Household for Classification and Planning
5. Epidemiological: Family/ Household for Serology
6. Serological Laboratory Tests: Report Results to Field
7. Entomological House Examinations (to record peri-domestic
   findings: Man-hour)
8. Parasitological Examinations of Captured Triatomes :
   (Species, developmental stage, location of capture, T.
   cruzi)
9. Entomological House Examination by Community: Maria
   Sensor, etc.
10. Laboratory Insecticide Susceptibility Tests (Use WHO
   forms)
11. Field Insecticide Bioassay Tests
12. Insecticide Intervention: Record of Use
13. Residual House Spraying
   (Use Standard MPSSP Malaria forms)
14. House Modification: Record of modification, materials
    used, costs and hours of work
15. Site Selection Form
ANNEX 8. BACKGROUND FOR SEROLOGY

A. Diagnosis of Infection by *Trypanosoma cruzi*.

A list of diagnostic procedures recommended for each stage of infection follows. The interpretation of results as well as advantages and limitations of the procedures are below.

1. Investigation of Acute Chagas Infection. For the study of patients suspected of acute Chagas infection, the following will be used:

A. The recommended parasitological methods are listed in order of complexity and sensitivity:

a) Fresh drop of blood.
b) Direct Strout or Micro-Strout method.
c) Blood culture.
d) Xenodiagnosis.

B. The serological methods for this stage are: indirect Immune-fluorescence (IFA), Immune-enzymatic Essay (ELISA), with marked conjugates of G and M anti-immunoglobulins (human).

2. Investigation of the Chronic Chagas Infection. The diagnostic method of choice in this stage is the detection of *T. cruzi* antibodies in the patients' serum utilizing at least two standardized serological techniques. A serological result will be considered as "reactive" when there is a reaction of the studied serum starting at the dilution indicated by the laboratory that produced the antigen.

* See page 73 of text
A diagnosis of infection could be made with at least two of the following tests:

1. Indirect Immune-fluorescence (IFA) and Indirect Hemagglutination (IHA).
2. IFA and Immune-enzymatic Essay (ELISA).
3. IHA and ELISA.

Parasitological methods are not effective because of a low degree of sensitivity.

5. Detection of the infection with *T. cruzi* in immunologically suppressed patients: organ transplant (donor and recipient), autoimmune diseases, AIDS, etc.

Patients who will either donate or receive an organ may be studied serologically. A parasitological diagnosis will be affected on the reactive recipients as outlined above. It should include isolating the parasite and inoculating it into a suckling mouse. A search for parasites should be carried out in the blood and spinal fluid of those patients which show clinical manifestations of a parasite infection after a transplant using quick methods such as Strout or Micro-Strout.

4. Interpretation of laboratory diagnosis: advantages and limitations.

The seropositive result is an indication of the infection with *T. cruzi*. However, due to the modality of this parasitosis, a negative result does not necessarily indicate an absence of infection. In view of this situation repeating the test or using another test is recommended (fifteen or 30 days later and in accordance with clinical and epidemiological evidence), especially when used to detect an acute Chagas infection or congenital Chagas.
The seropositive result constitutes an indication of infection and not to the clinical condition of the patient. This result will serve as a guide for the physician along with the clinical examination and medical history which will lead to the diagnosis of the patient's health condition.

The serological tests will be reported with the corresponding titers for each reaction that was used. Although the serological titers have shown no value as far as prediction of disease, it is recommended that these be included in the report next to the "reactive" or "not reactive" result, thus making it easier to study there possible clinical value in the infected human populations.

Should the results obtained be "in disagreement" it is recommended that a third serological reaction be performed, testing a new sample or forwarding it to a reference laboratory. Should the disagreement persist, it is recommended that parasitological studies be carried out in those patients.

5. Summary of the technology. - Since the antigenic reagents currently used do not respond to definite compositions, it becomes imperative to carry out strict standardization and control of all reagents used for the tests.

The reactions that form part of the proposed group of two tests have been standardized as far as sensitivity and specificity. A 100% diagnostic effectivity can not be ensured, but the two tests ensure a range of accuracy of 95 to 98.5%, as is the case with IFA and IHA.
B. Standardized Protocol for the Production of the T. cruzi antigen for the IFA

Laboratories: INLASA, IBBA, CENETROP and CUNETROP.

Reagents:
- Reference AP: Tulahuen.
- LIT culture medium.
- P.B.S. stabilizing solution, pH 7.2.
- Commercial formaldehyde.

Material:
- 20 ml. culture test tubes with screw-on cap (100 units).
- 50 ml. Ronx glass flasks (20 units). 250 ml. flasks (10 units) and 1000 ml. flasks (10 units).
- 5 ml. flasks (like those for penicillin) for the storage of antigen.
- Rubber caps and sealers.

Technique:
1. Massive culture.
2. Collection through centrifugation.
3. Rinsing at 3,000 r.p.m. (three times, 10 minutes each).
4. Fix with formaldehyde 10% prepared from commercial formaldehyde.
5. Rinsing at 3,000 r.p.m. (three times, 10 minutes each).
6. Adjustment of parasite concentration per ml. 30 x field.
7. Titration of the IFA antigen.
8. Dilute the antigenic suspension obtained in SSE, until the concentration of trypanosomes shows between 10 to 15
parasites in each 400 X microscopic field.
1. Pour 0.025 of this suspension in clean and greaseless.
2. Distribute it evenly on the surface using a wooden stick.
3. Dry them with hot air.
4. Fix by gently exposing to a flame.
5. Wash the slides with distilled water.
6. Dry with cold air.
7. Store in a refrigerator at a temperature of 4°C, inside a desiccator containing silica gel or in a freezer at a temperature of -20°C.

Observation: The antigen stored in a refrigerator remains stable for a year.

9. Distribution in vials to laboratories.
10. Preservation at a temperature of 4°C for transportation.

8. Cost per Diagnosis of 3 Dilutions of IFA

1. Expendibles: 0.04
2. Culture media: 0.16
3. Chemical reagents: 0.08
4. Containers and sealers: 0.04
5. Control Procedures: 0.04
6. Recovery of personnel: 0.08
7. Glass slide: 0.44
8. Total human Anti-immunoglobulin conjugate: 0.18
9. Spare bulbs for fluorescent microscope: 1.30
Protocol for the Production of Soluble T. cruzi Antigens for the ELISA technique

Institutes: INLASA, CEMETROP, SUMETROP and IBBA.

Reagents:
- Reference C1: Tulaneen
- L17 culture medium
- PBS, stabilizing solution, pH 7.0
- Commercial formaldehyde.

Materials:
- 20 ml. culture test tubes with screw-on cap (100 units).
- 30 ml. Non-glass flasks (20 units). 250 ml. flasks (10 units) and 1000 ml. flasks (10 units).
- 3 ml. flasks (like those for penicillin) for the storage of antigen.
- Rubber caps and sealers.

Technique:
1. Massive culture.
2. Collection through centrifugation.
3. Rinsing at 3,000 r.p.m. (three times, 10 minutes each).
4. Destruction of the parasite with ultrasound or pressure.
5. Dialysis.
7. Internal evaluation.
8. External evaluation.
E. Quality Control of the Diagnosis

It is recommended that laboratories follow these guidelines to determine the status of the serological reactions:

Method for screening of errors through precise controls of the quantitative reactions.

To carry out this method, a graph that shows control curves at a laboratory level depicting the results of sera pools taken as calibration sera.

Following is a description of the procedures used for the sera pools, control curves and guidelines for the decision making process during daily laboratory tasks.

4) Serum pools for controls. From the sera tests done on a routine basis, the positive and negative tests will be selected using two or three techniques. These samples will be preserved at a temperature of 20°C. The selected sera must be fresh, non-hemolized, non-nanomized, clear and without any abnormal coloring. Whenever there is a sufficient amount of sera, these will be refrozen to form the pools. Each pool must reach a daily result of 20 ml over a period of six months when IFA or IHA are used. After forming the pools an equal volume of neutral glycerine must be added and be divided in equal amounts. These pools will be preserved at -20°C until they are used for daily determinations. It is advisable to form two "positive" pools: one with low and the other with high reactivity.

5) Control Curve and its use. Together with the "turbina" tests, 4 equal amounts of sera will be analyzed. Two from the positive control pool and 2 from the negative control pool, which
will be given as unknown to the laboratory technicians. The results obtained each day for the positive pool will be registered in the graph as a logarithm (pool: Titer) versus the assay number (day). The Geometric Mean \(G_X\) will be calculated with no fewer than 30 results for each pool (15 days of work) and the Standard Geometric Deviation (SGD) as it appears in the attached Control Curve. The values of the acceptable positive results will be placed along the curve in the range summarised between the value of \(G_X\) and \(\pm\) one SGD. In order to accept an assay, besides the previous condition, it must be verified if the pools of negative sera have also obtained non-reactive results in the daily essay.

The laboratories that perform only qualitative techniques must include in their routine the positive and negative control sera calibrated by the reference laboratories. The positive percentages will be verified on a weekly or monthly basis for those positive sera, according to the technique that was used and the indications of the reference laboratory. The negative sera must always yield negative results, otherwise the assay will be invalidated.

1. Simplified Guidelines for Decision-Making

The negative serum pool must always yield "non-reactive" results.

- The daily results for the "positive pool" will be accepted if these appear on the graph between the range of \(\pm 1\) SGD.

- If the result registered on the graph is higher or lower than the accepted range, or if a negative serum gives "reactive" results, the daily result must not be taken accepted. In this case, all procedures must be revised as well as all the materials and equipment used for the tests in order to find the cause of the discrepancy.
The Fatale Chaben Institute in Buenos Aires, Argentina offers
the Bolivian laboratories the following:

a. Training in this method whenever it is deemed convenient
or necessary.

b. Calibration sera to begin the work.

Besides the error detection method, there are other
guidelines, which as a whole, form an Internal Program for Quality
Control in each laboratory. These guidelines will not be analyzed
until the results of this first stage of joint work among the
laboratories are obtained.

F. INVESTIGATION

1. Investigation of Cross Reactions

Background.—The cross serological reactions between
protozoans is already known, as is the case with *T. cruzi*,
Leishmania and Plasmodium.

Objective.—To determine the impact that such cross reactions
have on the diagnosis of Chagas in Bolivia, and to investigate by
means of a poll whether there are superposition zones of Chagas,
malaria and/or Leishmania infections within Bolivia.

Methodology.—

1. To analyze 50 samples of sera taken from patients infected
with Chagas, Leishmania and malaria who come from areas where the
other two infections are not present and to test with the IFA for
Chagas, Leishmania and malaria to determine the threshold of
specificity for each one of them.
To take a random sampling of 7% of the populations being studied and test those sera with IFA for Chagas, leishmaniasis and malaria. The sera that surpasses the aforementioned threshold of specificity must be investigated and subjected to complementary examinations to clarify the diagnosis.

2. Investigation of Parasite Components in Biological Fluids

Background.- Serology measures the antibodies, that is to say the response of the host against a parasitic infection, and does not depict the degree of parasitism. The parasitological techniques for chronic Chagas infection have a sensitivity of only 30% and are difficult to manipulate and are costly.

Objective.- It is important to find new techniques which will allow for the detection of circulating or soluble antigens that show the presence of the parasite. This is of importance in the diagnosis of patients whose immune response is suppressed or in the evolution of chemotherapy.

Methodology.- Two groups of sera 501 will be processed. one from positive xenodiagnosis and the other from negative xenodiagnosis.

Using these sera experiment with the monoclonal anti T. cruzi antibodies such as KATZIN, FRASH and RUIZ, with the ELISA sandwich test and using serum and urine for the detection of soluble antigens.

Study the population dynamics of T. infestans with respect to the contents of the digestive system.

To identify the source of blood found in the digestive system.
of the T. cruzi vector, using the dot-ELISA technique which has a high sensitivity and specificity. This study should show the movement patterns of T. infestans between the domestic and the peridomestic cycles. The vinchuca for the study will be those captured during the entomological evaluation of different houses in different geographic and climatic regions within Bolivia.

3. Essays of Molecular Markers of T. cruzi for Pathology

There are molecular markers of donated and native T. cruzi that reveal through ELISA with an 90% degree of accuracy the possibility that an infected individual may have cardiological pathology. If the markers function in Bolivia, this would represent a savings of about 20 U.S. dollars per patient a year, the equivalent of doing one electrocardiogram per year. The project could be carried out in a year and would require funding of about US$ 0.00 would be required.

4. Determination of Isotypes of Anti T. cruzi Antibodies in Patients with Acute Chagas Infection and Congenital Chagas

The objective of the study is the identification and comparison of the rates of the different isotypes of antibodies that intervene in acute or congenital Chagas infection. This study would attempt to find markers of the acute and congenital forms other than IGM which is not currently considered as ideal for the diagnosis of those clinical forms.

The presence of specific IGM in the acutely ill or congenital patient is not enough to justify treatment. The precise investigation of other specific isotypes might identify a more adequate marker concerning these two clinical forms, for which a therapeutical decision becomes imperative.
5. Isolation of Strains of T. Cruzi

Strains of T. cruzi will be isolated from patients infected with acute or chronic Chagas and from infected triatomines in compliance with the norms established by WHO (Belo Horizonte, Brazil, February-March 1, 1986, page 2).

These strains will be classified according to monoclonal antibodies and isoenzymes identified.
ANNE P. PROTOCOL : Comparison of Four Methods for Entomological Surveillance

Introduction

Man-hour searches of houses for triatomines are labor intensive and are difficult to do with the frequency required to evaluate the house modification component of the Program. Passive techniques are available, but they have not been adequately studied in Bolivia.

The objective of this study is to select a surveillance system that can be standardized and utilized by community participation.

Study Site and House Selection

Cochabamba has been selected for the study. The exact villages will depend upon site visits by the MPSSP-CCH Chagas' team. The sample size will be 300 houses (75 houses for each surveillance method).

Every fourth house will have the same type of surveillance method applied, e.g.

- Houses 1 - 5 - 9 - 13 = Maria Sensor
- Houses 2 - 6 - 10 - 14 = Adhesive Tape
- Houses 3 - 7 - 11 - 15 = Picture-Calender
- Houses 4 - 8 - 12 - 16 = Family Collections
Methods and Materials

The Maria Sensor is a modified Gomez-Muñoz trap. Two sensors will be placed in the bedroom at bed level in houses 1 - 5 - 9 - 13, etc. In the second group of houses, a two meter square of adhesive or sticky tape will be placed on the wall near the bed. Calendars or pictures will be hung near beds in the third group of houses. These three methods are passive in nature. The fourth requires active participation. Any family member that observes a triatome in the house, collects it in a small box.

On Monday of every week (every 7 days) each type of trap will be inspected by a designated representative of the community. All triatomes will be collected for identification and triatome signs, e.g. exuviae or fecal drops noted. At the same time the triatomes from family collection will be taken for identification.

A comparison of the four methods will be made monthly. If a statistically valid difference is noted in six months, the best technique will be used in the entire site. If not, the study will continue for one year.

Besides efficacy, comparisons will be made on family acceptance, cost, durability of the product and weak/strong points associated with use.