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Bolivia: Current Status and Potential Development of Control Strategies for Chagas' Disease

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by

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and

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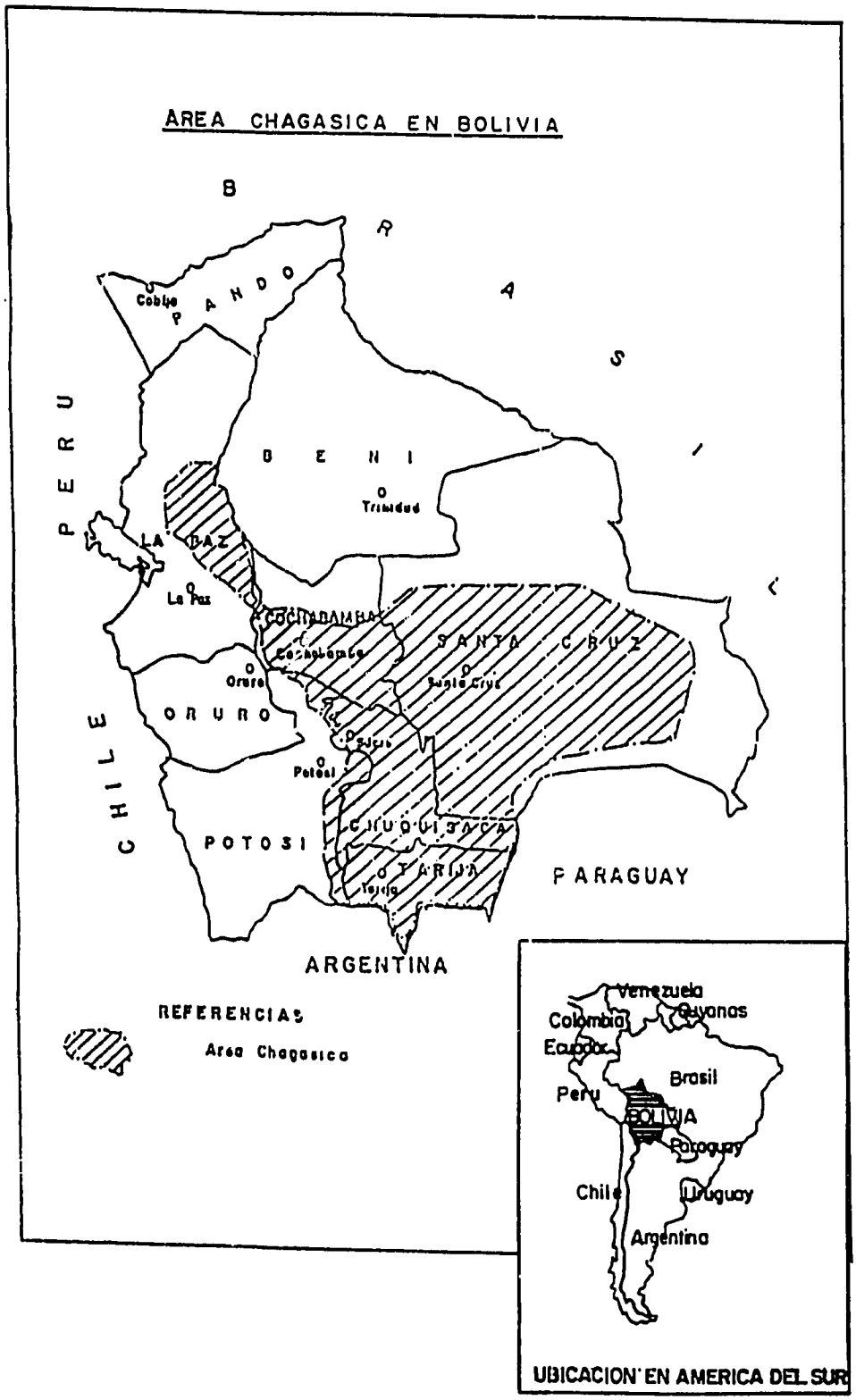
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1. Resumen Ejecutivo

En respuesta a una solicitud de USAID/La Paz, el Proyecto "Vector Biology and Control" (Biologia y Control de Vectores), envió a Bolivia a los Drs. Ralph T. Bryan, M.D., epidemiologista de la CDC, y Robert J. Tonn, Ph.D., consultor de VBC, del 26 de febrero al 23 de marzo de 1990. El control de la enfermedad de Chagas', originalemente pese a no ser un componente importante del Programa de Supervivencia Infantil de Bolivia, la Misión solicitó la elaboración de un documento para la planificación de las actividades futuras durante la duración del Programa. El objetivo del trabajo incluía un análisis del Programa Nacional de Chagas, un análisis de las actividades de control en el país (incluyendo el trabajo realizado por las OVP's en areas chagásicas), la identificación de areas en las que el Proyecto VBC y los grupos de donantes hayan prestado asistencia a la Misión en relación a Chagas y otras enfermedades producidas por vectores, y la presentación de una evaluación general sobre la importancia de la enfermedad de Chagas en el contexto del problema de salud a nivel nacional.

Participamos en una serie de reuniones de información preliminar en la Misión, en PROCOSI (con los representantes de las OVP), y en el Departamento de Epidemiología del Ministerio de Salud. El Ministerio colaboró en la elaboración de un itinerario de vistas de dos semanas, que incluían visitas a los proyectos de las OVP, Unidades Sanitarias, proyectos de control de malaria, hospitales, universidades, instituciones de investigacion y observación de campo en Tupiza, Tarija, Sucre, Santa Cruz y Cochabamba.

En cada lugar en cuestión solicitamos documentación y publicaciones sobre la enfermedad de Chagas y las analizamos conjuntamente con los clínicos, especialistas de control y los administradores del proyecto. Visitamos viviendas infectadas con *Triatoma* y conversamos con sus ocupantes, observamos los proyectos de mejoramiento de viviendas, y evaluamos las actividades de fumigación con insecticida. En cada area, tratamos de correlacionar estas observaciones con otras actividades de control de enfermedades producidas por vectores.

Encontramos que la enfermedad de Chagas es endémica en cada región que visitamos. Entre Bolivia-Argentina, en 1986, se había aplicado un programa conjunto, en Tupiza y parte de Tarija, para la fumigación de basurales a domicilio, pero no pudimos evaluarlo completamente. El Proyecto de Desarrollo Agropecuario (FIDA) y la Unidad Sanitaria local tiene en Tupiza un componente de mejoramiento habitacional para el control de Chagas. Este proyecto encontró

100% de las poblaciones infectadas, 85% de las casas, una tasa de seropositivo humano de 35%, cardiopatîas de origen chagâsico 15%, y una tasa seropositiva en mujeres embarazadas de 25%.

Tarija tiene un alto nivel de infestaciôn de *Triatoma* en los barrios sub-urbanos, estando vigente la fumigaciôn domiciliaria con BHC. Existen dos proyectos PVO en esta regiôn, uno en la etapa de planificaciôn y el otro, patrocinado por CARE, se està desarrollando a nivel global de las organizaciones comunal, nutriciôn, educaciôn en salud y mejoramiento habitacional.

El Proyecto Britânico en Sucre fue el mejor proyecto de control de Chagas observado. Es un proyecto pequeño pero bien organizado, con enfâsis en la participaciôn de la comunidad, en educaciôn en salud, fumigaciôn y mejoramiento de viviendas. Podrîa servir de modelo para otros proyectos de control de Chagas. Plan Internacional tambiên tiene un programa de mejoramiento de viviendas en esta regiôn pero no parece estar aplicando el enfoque basado en la comunidad.

La mayorîa del control de vectores en Santa Cruz està dirigido a *Aedes aegypti*, ya que se ha presentado una epidemia de fiebre amarilla en las areas rurales de Santa Cruz y Cochabamba. Los îndices de infestaciôn de las casas con *Aedes aegypti* se aproxima a 40% en la ciudad y 64 de las poblaciones circundantes està infestada. El acceso a los viajes aêreos entre Santa Cruz y Venezuela (ârea de la actividad del dengue) aumenta mâs el riesgo de contraer dengue.

CENETROP, antes un centro dominante de investigaciôn en Bolivia, tiene graves problemas de financiamiento y se ha reducido principalmente al diagnôstico y a los deberes de enseñanza. Han demostrado la transmisiôn congênita de *T. cruzi* hasta dos generaciones y tienen varias excelentes propuestas pendientes de financiamiento.

ORSTOM, IBBA, UMSS han concluîdo un proyecto pequeño de Chagas en Cochabamba, pero no se dispone de datos. Nos dijieron que la poblaciôn de vectores era tan alta en los alrededores, que la gente ya no dormîa bajo techo. En las areas sub-urbanas de la ciudad de Cochabamba, la infestaciôn es cerca del 40%. Es la ûnica area donde el ciclo *T. infestans* silvâtico se ha demostrado, pero el ciclo indudablemente ocurre en otra parte.

Mâs de 3.000.000 bolivianos viven en areas endêmicas de Chagas. En esta ârea, las tasas de infecciôn domiciliaria varian de 20-40% en las areas urbanas, a 70-100% en las âreas rurales, estando un 50% de los triatomes examinados infectados con *T. cruzi*. A nivel nacional,

cerca del 40% de la poblaciôn boliviana es seropositiva y, en algunas âreas, se ha demostrado la existencia de 70-100% de seropositivos. En un estudio, 70% de los niños menores de 5 años eran seropositivos. Las encuestas de mujeres embarazadas demuestran que un 25% son seropositivas pero en dos encuestas se muestran tasas hasta de 80%.

La transmisiôn congênita varia entre 8 el 36% y las tasas de seropositividad en la sangre son de 45-70%, o cerca de tres veces mâs que la Argentina, Brasil, Chile o Venezuela. La evidencia de EKG para cardiopatologîa chagâsica es prevalente en 15-28% de los bolivianos seropositivos, y en una encuesta, fue mâs del 40%. Cinco por ciento de los niños seropositivos tiene anormalidades EKG cerca de los 15 años. Las evidencias tambiên sugieren la presencia de patologîa gastrointestinal significativa. Las tasas de mortalidad infantil oscilan entre 2.6 al 46% con un nivel de mortalidad nacional de 32% para casos congênitos.

La conclusiôn es que Bolivia es el paîs mâs afectado del mundo con la enfermedad de Chagas'. La enfermedad de Chagas' es aquî sin duda la mâs importante producida por vectores, y probablemente es el problema nûmero uno dentro de la salud pûblica del paîs. El hecho de que Bolivia no tenga un programa nacional de control de la enfermedad de Chagas', causa asombro, pese a que en gran medida es una enfermedad que se puede prevenir. La falta de un programa de esta naturaleza estâ costando al paîs millones de dôlares en ausentismo y cuidado mêdico. Aunque los datos estadîsticos son limitados, el impacto de los abortos/partos prematuros, la morbilidad y mortalidad infantil, de por sî deben asignar a la enfermedad de Chagas' una alta prioridad en el Programa de Supervivencia Infantil.

Las recomendaciones se concentrarîan en el financiamiento de un proyecto nacional de control, con componentes en tratamiento de las viviendas con insecticidas, educaciôn en salud, mejoramiento de viviendas y participaciôn de la comunidad. Las actividades del proyecto deben integrarse con otras de control de enfermedades producidas por vectores, a fin de reducir los costos y aumentar la eficiencia. Cualquier financiamiento debe ser substancial y a largo plazo. Consecuentemente, quizâ se tenga que desarrollar un conglomerado de agencias donantes. La complejidad de la situaciôn requerirâ un nûmero de diferentes niveles de coordinaciôn que, al presente, no existe. Si se materializara un proyecto de control, se tendrîan que mejorar los canales de comunicaciôn entre el personal clînico y preventivo, entre el gobierno y las OVPs, y entre el campo y la ciudad de La Paz, finalmente entre los donantes y los beneficiarios.

Ya que el ênfasis estâ en el control sostenido, el mejoramiento de

la vivienda y la educaciôn tendrân que recibir mayor ênfasis a medida que el proyecto progrese. Las especialidades en estos campos tendrân que ser fortalecidas. Es esencial contar con algûn mecanismo para prêstamos destinados al mejoramiento de la vivienda si el gobierno-donantes quieren alcanzar una cobertura a nivel nacional. Existe una buena base de experiencia en el control de vectores y en epidemiologîa, pero serâ necesario contar con respaldo de consultores y algûn tipo de capacitaciôn.

La enfermedad de Chagas' siempre fue considerada como una enfermedad socio-econômica y por tanto se requerirân medidas sociales-culturales-econômicas, asî como cambios en las polîticas de salud pûblica a fin de erradicar la carga tremenda que significa esta enfermedad para la poblaciôn boliviana.

2. Executive Summary

In response to a request from USAID/La Paz, the Vector Biology and Control Project sent Ralph T. Bryan, M.D., a CDC medical epidemiologist, and Robert J. Tonn, Ph.D., a VBC consultant, to Bolivia from February 26 to March 23, 1990. Although Chagas' disease is not a major component of Bolivia's Child Survival Program, the Mission requested a concept paper for planning future Chagas' control activities during the life of the project. The scope of work included a review of the national Chagas' program, a review of control activities within the country, including work done by private volunteer organizations (PVOs) in "chagastic" areas, identification of areas where the VBC Project and donor groups might assist the Mission in strengthening efforts to control Chagas' and other vector-borne diseases, and an assessment of the importance of Chagas' disease as a national health problem.

We participated in a series of briefings with the Mission, PROCOSI (with PVO representatives), and the Department of Epidemiology, Ministry of Health. The Ministry assisted in outlining a two-week trip including visits to PVO projects, health units, malaria control projects, hospitals, universities, research institutions and field observations in Tupiza, Tarija, Sucre, Santa Cruz and Cochabamba.

At each place we visited, we requested documents and publications on Chagas' disease and held discussions with clinicians, control specialists and program administrators. We visited triatome-infested houses and talked with the occupants, observed house improvement projects and evaluated insecticide spraying activities. We attempted to correlate these observations with other vector-borne disease activities in each area.

Chagas' disease was highly endemic in every area we visited. A joint Argentina-Bolivia residual spray program had treated houses in Tupiza and part of Tarija in 1986, but it had not been fully evaluated. The Proyecto de Desarrollo Agropecuario (FIDA) and the local Unidad Sanitaria in Tupiza have a house improvement component for Chagas' control. This project found 100 percent of the villages infested, a human seropositivity rate of 35 percent, a chagastic cardiopathy rate of 15 percent in seropositive individuals, and a seropositivity rate in pregnant women of 25 percent.

Tarija has a high level of triatome infestation in peri-urban barrios. House fumigation with BHC is underway. There are two

PVO projects in the area. One is in the planning stage and the other, sponsored by CARE, is working in community organization, nutrition, health education and house improvement.

The "Proyecto Britanico" project in Sucre was the best Chagas' disease control project we observed. It is small and well-organized, emphasizing community participation, health education, house fumigation and improvement. It could serve as a model for other Chagas' control projects. Plan International also has a house improvement program in this area, but does not appear to use a community-based approach.

The majority of vector control activities in Santa Cruz are directed towards *Aedes aegypti* because a yellow fever epidemic is taking place in rural Santa Cruz and Cochabamba. *Aedes aegypti* house infestation indices approach 40 percent in parts of the city and 64 surrounding villages are infested. The ease of air travel between Santa Cruz and Venezuela, where a dengue epidemic is occurring, makes the risk of dengue great.

CENETROP, once a dominant research center in Bolivia, has severe financial problems and staff members are reduced to primarily diagnostic and teaching duties. CENETROP researchers have demonstrated two-generation congenital passage of *T. cruzi* and have several excellent research proposals awaiting funding.

ORSTROM, IBBA and UMSS have completed a small Chagas' project in Cochabamba, but data are not yet available. We were told that the vector population was so large in the vicinity that people were no longer sleeping indoors. In the peri-urban areas of Cochabamba city, house infestation is about 40 percent. This region is the only area where a sylvatic *T. infestans* cycle has been demonstrated, but the cycle undoubtedly occurs elsewhere.

More than 3 million Bolivians live in the Chagas'-endemic area. In this area, house infestation rates vary from 20 to 40 percent in urban areas to 70 to 100 percent in rural areas, with about 50 percent of the triatomes examined being infected with *T. cruzi*. Nationally, about 40 percent of the Bolivian populace are seropositive and 70 to 100 percent seropositivity has been demonstrated in some areas. In one study, 70 percent of children younger than five were seropositive. Surveys of pregnant women show about 25 percent seropositivity, but two surveys showed rates as high as 80 percent.

Congenital transmission ranges from 8 to 36 percent. Seropositivity rates in blood donors are 45 to 70 percent, or about three times that of Argentina, Brazil, Chile or Venezuela. EKG evidence for chagastic

cardiopathology is present in 15 to 28 percent of seropositive Bolivians. In one survey, it was found in more than 40 percent. Five percent of seropositive children have EKG abnormalities by age 15 years. Evidence also suggests the presence of significant gastro-intestinal pathology. Childhood mortality rates range from 2.6 to 46 percent, with a national mortality level of 32 percent for congenital cases.

Our conclusion is that Bolivia is the country most affected by Chagas' disease in the world. Chagas' disease is certainly the most important vector-borne disease here and is probably the country's number one public health problem. It is disturbing that Bolivia does not have a national Chagas' disease control program because the disease has been shown to be largely preventable. Although statistical data are limited, the disease's impact on stillbirths and abortions and infant/child morbidity and mortality should make Chagas' a greater priority in the Child Survival Program.

The lack of a national program to control Chagas' disease is costing Bolivia millions of dollars in absenteeism and medical care. In Brazil, where Chagas' disease seroprevalence is about four percent, compared to Bolivia's 40 percent, the estimated annual cost of medical care due to the disease is $250 million. Brazil loses an additional $5 billion a year because of absenteeism caused by Chagas' disease.

Our recommendations center on funding a national control project with components in insecticide treatment of houses, health education, house improvement and community participation. The activities of the project should be integrated with other vector-borne disease control activities to reduce cost and increase efficiency. Any funding should be substantial and long-term. Consequently, collaboration between donor agencies might be necessary. The complexity of the situation requires coordination at all levels, which, at present, does not occur. Channels of communication between clinical and preventive staff, government and PVOs, field and La Paz, and donors and recipients must be improved if a control project is initiated.

Since the final emphasis is on sustainable control, house improvement and education will have greater priority as the project progresses. Expertise in the field will have to be strengthened. Some mechanism for house improvement loans is essential if the government and donors expect nationwide coverage. There is a good base of expertise in vector control and epidemiology, but consultant support and some training will be necessary.

Chagas' disease has always been considered a socio-economic disease. It will require social, cultural and economic measures as well as changes in public health policy to lift the tremendous burden of this disease from the people of Bolivia.

3. Introduction

It is estimated that there are more than 24 million cases of Chagas' disease in Latin America. These cases represent about eight percent of the total population. Approximately 850,000 new cases occur each year. Of the 24 million cases, about 10 percent may die and 40 percent may suffer chronic symptoms.(1) It is believed that Chagas' morbidity and mortality are higher in Bolivia than anywhere else in Latin America. Long-term control programs have succeeded in reducing Chagas' prevalence in the other countries most affected by the disease: Argentina, Brazil and Venezuela.(2,3,4) In Bolivia, the chief vector of Chagas' disease is *Triatoma infestans*. Pathology resulting from infection transmitted by this vector is believed to be more severe than that resulting from infection transmitted by other triatomine vectors.

Because Chagas' is an important public health problem, USAID/ La Paz has included Chagas' control in the Bolivian Child Survival Program. Although Chagas' disease is not a major component of the program, the Mission requested this initial consultation to prepare a concept paper for planning future Chagas' control activities during the life of the project.

The objectives of the consultation included the following:

1. To review the current national Chagas' program and any future plans of action, including funding sources.

2. To review local Chagas' disease control activities in areas where they exist or are in the planning stage.

3. To review the work of the PVOs that work in "chagastic" areas and advise the Mission about how they could contribute to control efforts.

4. To assist in developing a national control strategy or a small pilot control project.

5. To identify areas in which the VBC Project might continue to assist the Mission in strengthening efforts to control Chagas' and other vector-borne disease important to the Child Survival Program.

6. To identify sources of expertise in Chagas' disease research in Bolivia.

Upon arriving in Bolivia, we were asked by the Mission and the Department of Epidemiology of the MPSSP to look at the efforts to control other vector-borne diseases within the area endemic for Chagas' disease and to consider ways of integrating the various control strategies. Special attention was to be given to malaria in Santa Cruz, Sucre, Tarija and Cochabamba and to the density and distribution of *Aedes aegypti* in Cochabamba and Santa Cruz, where a yellow fever epidemic is occurring. We were also requested to review the role of the entomology auxiliary and comment on ways to strengthen the entomological component of the vector control program.

The consultancy lasted from 26 February until 26 March 1990. Initial briefings were held at the VBC Project office in Arlington, Virginia, USAID/La Paz and the Department of Epidemiology, MPSSP. Fifteen days were spent visiting Tupiza, Tarija, Sucre, Santa Cruz and Cochabamba. During the trip, we visited a number of house modification projects and met with staff members of the Unidad Sanitaria, local PVOs, hospitals, research institutions and universities. Debriefing sessions were held in La Paz and Arlington.

We concluded that technical support was needed to initiate the National Chagas' Control Project. Any support would have to be long-term if economic development and projects to improve the quality of life of people living in Chagas' disease-endemic areas of Bolivia are to be successful.

4. Background

Bolivia

The Republic of Bolivia is located in central South America. It is a land-locked nation that shares frontiers with five other South American nations: Brazil, Paraguay, Argentina, Chile and Peru. Bolivia is the fifth largest country on the continent, with a territory of 1,100,000 square kilometers, or 450,000 square miles. Its major cities are La Paz, the administrative capital, Sucre, the official and judicial capital, Santa Cruz and Cochabamba.

Politically, Bolivia is considered a democratic centralist republic in which a president and vice-president are elected for non-renewable four-year terms by direct universal suffrage and simple majority. Administratively, the country is divided into nine departments, 98 provinces and 1,272 cantons.

Geographically and ecologically, Bolivia has three clearly-defined regions: the mountains and high plains (altiplano); the valleys, or yungas; and the lowlands, or llanos. The highlands are located at 3,800 meters above sea level and occupy 16 percent of the national territory. The valleys, located between 1,000 and 3,000 meters, constitute 19 percent of the territory. The plains, extending eastward towards Brazil and Paraguay, occupy the remaining 65 percent of Bolivian territory.

Approximately 80 percent of Bolivia's population resides in the highlands or valleys. Urban or peri-urban residents comprise about 36 percent of the total population, which is currently estimated at between 6 and 7 million individuals. Sixty-four percent of the population lives in widely dispersed rural areas. Population density is the lowest in South America at 5.5 per square kilometer, or 15 per square mile. Population growth is estimated to be 2.6 percent annually.

The population is composed of 55 percent Indian (Aymara 25 percent, Quechua 30 percent -- smaller, dispersed groups in Beni and Pando Departments are apparently not counted); 5 to 15 percent European (primarily Spanish descent); and 25 to 30 percent mestizo. Thirty-six percent of the population speaks only Spanish and 25 percent speaks only Aymara or Quechua. Population structure is young, with children younger than 15 comprising 43 percent of Bolivia's population, while persons 65 years and older make up only three percent.

Economically, Bolivia is second only to Haiti as the poorest nation in the Western Hemisphere. The country is heavily in debt. Continued low world market prices for mineral resources and a largely subsistence, agriculture-based economy have impeded economic development. In 1985, the gross national product (GNP) was US $4 million and per capita income was $536. Agriculture produces 17 percent of the GNP, yet employs about half the labor force. Only 10 percent of agricultural workers are wage earners. Industry (manufacturing and mining) and commerce employ approximately 19 percent of the work force, services 23 percent, and the government 11 percent.

Life expectancy in Bolivia is currently estimated at 48 years for males and 53 years for females. Bolivia's infant mortality rate is 110 per 1,000 live births, second in the region only to Haiti's 117. Infant mortality rates in all other countries in the Latin America and Caribbean region are below 70. The major causes of morbidity and mortality (the latter being highest among the very young) are respiratory, gastrointestinal and parasitic ailments, trauma, pregnancy complications and malnutrition. It is interesting to note that among these six categories, Chagas' disease probably plays a significant role in three: parasitic ailments, pregnancy complications and malnutrition. In addition, the contribution of chagastic pathology to Bolivians decreased life expectancy must be considered.(5,6)

Chagas' Disease

Chagas' disease is named for Carlos Chagas, the Brazilian scientist who described the disease in 1908. He subsequently described the vector and parasite. Chagas' disease, or South American trypanosomiasis, is caused by the flagellated protozoan, *Trypanosoma cruzi*. The infection exists in both domestic and sylvatic cycles. More than 150 wild and domestic mammals serve as reservoir hosts. Examples of hosts include: armadillos, raccoons, opossums, wild rodents, dogs, cats, guinea pigs, rabbits and goats.

Several genera and species of triatomine insects ("kissing" or cone-nosed bugs, also known as "vinchucas" in Bolivia) serve as vectors of Chagas' disease. They become infected during a blood meal, but transmit the infection to the next host by contaminating the bite site with feces containing *T. cruzi*. The parasite is capable of multiplying in both host and vector. Infection with *T. cruzi* can also be transmitted congenitally (up to two generations) and hematogenously by blood transfusion.(6,7)

The clinical manifestations of Chagas' disease occur in three primary forms: acute disease, latent or indeterminate infection, and chronic disease. Acute infection may vary from being asymptomatic or unrecognized to a severe and fatal disease. The acute phase is recognized primarily in children, who develop fever, enlargement of the liver, spleen and lymph glands, and, in about 50 percent of cases, a unilateral swelling of the eyelids known as Romaña's sign. Mortality during this phase is approximately eight percent and generally results from severe myocarditis (inflammation of the heart muscle) or meningoencephalitis (inflammation of the brain and the membranes enveloping the brain and spinal cord). In non-fatal cases, symptoms usually last from three to four weeks.(6,7)

The latent or indeterminate phase follows the acute phase and is characterized by low-level parasitemia and an absence of clinical signs or symptoms. Patients in this phase of the illness, however, are still capable of transmitting the infection via vectors, blood transfusion or placental transfer.(6,7)

The chronic form of Chagas' disease develops in at least 10 to 30 percent of infected patients some 10 to 15 years after the acute phase. Patients with chronic disease develop heart muscle damage and cardiac rhythm disturbances. Sudden death due to cardiac arrest is not uncommon. Chagas' disease is said to be the most common cause of congestive heart failure in South America. The gastrointestinal tract also may be affected and pathologic changes may result in enlargement of the esophagus or colon (megaesophagus and megacolon), which cause severe swallowing and digestive disorders.

Chagas' disease occurs only in the Western Hemisphere, where it can be found in various areas from Argentina to Texas and California. It is a socio-economic disease that is perpetuated primarily by inadequate housing. Homes with cracked mud walls (adobe) and mud and thatch roofs provide ideal habitats for the triatomine vectors. The close association between human dwellings and domestic animals that is so common in rural Latin America plays an integral role in the domestic cycle of this infection.

In Bolivia, Chagas' disease occurs primarily in the valleys, plains and forests lying between altitudes of 300 and 3,500 meters above sea level. Roughly 83 percent of Bolivian territory lies within this endemic zone. Forty-seven percent of Bolivia's populace resides in endemic areas, thereby placing approximately 3 million people at risk for Chagas' disease. Even more people are at risk because of the possibility of infection through blood transfusions in non-endemic urban areas.(a)

Clinical and epidemiologic data on Chagas' disease in Bolivia are somewhat limited, often difficult to find, and sometimes suspect in quality. Nevertheless, data do exist that provide certain insights into the ominous public health problem that this disease poses for Bolivia. Indicators of public health impact include household triatomine infestation rates, rates of triatomine infection with *T. cruzi*, seroprevalence rates and assessments of morbidity and mortality.

In general, household infestation rates in Bolivia are higher in rural and peri-urban areas, but urban infestation certainly is present. Regardless of the locale, infestation rates are always higher in poorly constructed houses. Infestation rates compiled from various sources in Bolivia can be summarized as follows:

Rural	70-100%
Peri-urban	40-60%
Urban	20-40%

Rates of *T. cruzi* infection in captured (domestic) triatomes average 40 to 50 percent, but rates of 70 to 90 percent have been encountered in rural areas of Cochabamba and Chuquisaca Departments. (a,b,c,f,k,8,9,10).

Since the mid-1970s, national, regional and local serological surveys have produced disturbing results. In an elegantly designed and executed national survey performed in 1981-1982, the seroprevalence of Chagas' disease in Bolivia was determined to be 40 percent.(a) However, various regional surveys of the general population found rates of 50 to 70 percent.(a,b,c,e,f,g,11,12)

Age-stratified serosurveys reveal alarmingly high prevalence in children and young adults. Rates have ranged from 11 percent in urban surveys of children younger than five to 70 percent for children in the same age group living in rural areas. Seroprevalence among school-age children has been as high as 75 percent in some areas, with a national average of approximately 35 percent. One survey of 18- to 22-year-old military recruits showed a seroprevalence of 45 percent. (a,c,k,n,7,10,11)

Serosurveys designed to evaluate the role of congenital transmission of Chagas' disease also have been completed in Bolivia. Seroprevalence in pregnant women has ranged from 25 to 50 percent in most studies, but at least two surveys yielded rates as high as 80 percent. Rates of infection in infants born to chagastic mothers -- an indication of congenital transmission rates -- have ranged from 8 to 36 percent.(a,8,9,13)

Since 1977, five serosurveys of Bolivian blood donors have been completed. Among these, the lowest chagastic seroprevalence reported was an alarming 45 percent. In the remaining four surveys, seroprevalence ranged from 56 to 70 percent. Based on these figures and studies of blood recipients, the risk of transmission of Chagas' disease through donated blood has been calculated to be 46 percent -- or roughly a one in two chance of being infected if transfused in Bolivia. In the departments of Cochabamba. Santa Cruz and Chuquicaca, the Ministry of Health has estimated that in 1988 alone, transfusions resulted in five new cases of Chagas' per day.(a,j,k,11, and Toro, personal communication)

In a country that is limited by both technical capability and access to health care, reliable measures of morbidity and mortality are difficult to obtain. Fortunately, at least in the case of chagastic cardiopathy, a relatively reliable indirect measure of morbidity is available through the use of electrocardiography. Reasonably specific and standardized guidelines for interpreting electrocardiographic (EKG) abnormalities suggestive of Chagas' disease have been in use for several years. EKG evidence obtained using such guidelines shows that chagastic cardiopathy is present in 15 to 28 percent of seropositive Bolivians.

These abnormalities are not limited to older age groups. Among the seropositive 18 to 22-year-old military recruits surveyed near Sucre, 18 percent had EKG abnormalities (Toro, personal communication) In the small community of Tabacal in Cochabamba Department, 41 percent of seropositive persons with EKG abnormalities consistent with chagastic cardiopathy were younger than 40 years of age.(12) Even children are affected. On the national level, five percent of seropositive children have EKG abnormalities by age 15 years.(8,10,11,13,a,k)

In addition to cardiac pathology, there is some evidence to suggest the presence of significant gastrointestinal pathology. Again in Tabacal, swallowing times were abnormally prolonged (an indirect measure of esophageal dysmotility) in 16 percent of seropositive individuals.(12) In a hospital in Tarija, 3.4 percent of approximately 7,000 patients undergoing gastrointestinal surgery had evidence of megacolon or volvulus suggestive of Chagas' disease. (e,12)

Autopsies are rarely performed in Bolivia and many patients die in rural areas without preceding medical evaluation. Therefore, mortality data are scarce. Moreover, estimates that have been made based on available data are likely to underestimate true mortality rates. For chronic Chagas' disease, mortality has been estimated at 13 percent overall (ages 15-74 years). However, for males aged 25 to 44

years, this figure more than doubles to 29 percent. The comparable figure for females is 22 percent.(12,a, Toro, pers. comm.) Although a figure of eight percent is commonly quoted for mortality from acute Chagas' disease, childhood mortality rates from this phase of the disease in Bolivia have ranged from 2.6 to 46 percent. For congenital cases, Valencia has reported a national-level mortality rate of 32 percent.(a,8,10) Based on extrapolations of data from its 1981-82 seroprevalence survey, the Ministry of Health estimates that seven newborns and six pregant women die from Chagas' every day in Bolivia.(a)

The lack of a national program to control Chagas' disease is costing Bolivia millions of dollars in absenteeism and medical care. In Brazil, where Chagas' disease seroprevalence is about four percent, compared to Bolivia's 40 percent, the estimated annual cost of medical care due to the disease is $250 million. Brazil loses an additional $5 billion a year because of absenteeism caused by Chagas' disease.

5. Findings

Tupiza

Tupiza is located in an arid region of southeastern Bolivia, not far from the Argentinian frontier. The elevation is 2,956 meters above sea level. In Tupiza, the local Unidad Sanitaria (regional office of the Ministry of Health), in cooperation with the international donor/ development agency known as FIDA, has initiated a regional-level Chagas' disease control project. This project has been in operation since 1986 and covers an area of approximately 20 square kilometers. Within this area are three provinces (Nor Chichas, Sur Chichas, and Modesto Omiste), 185 communities, 10,954 households and a population of approximately 50,000 people. The project budget is $876,000.

The project consists of a four-phase plan: preparation, attack, consolidation and evaluation. This plan relies heavily upon food donations from Programa Mundial de Alimentos (PMA), which provides basic foodstuffs at reduced prices to families who complete predetermined home improvements. Details of this four-phase plan are outlined in table 1.

The Tupiza project (g) is an ambitious one that suffers from limited funds and personnel, both of which appear to be inadequate for the size of the project. These limitations make surveillance particularly difficult. In addition, much of the planned house modification has been incomplete and there may be design flaws in the project's modified chicken and rabbit dwellings. Despite these drawbacks, the project's integrated approach (insecticides, education, house improvement) and emphasis on community participation are appropriate and should be encouraged. The project could benefit from not only increased funding, but additional technical expertise. External technical consultants and exchange of information with other control projects would greatly enhance the efficacy of the Tupiza Chagas' Disease Control Project.(g)

Table 1*

Tupiza Chagas' Disease Control Project

1. Preparation

   a. census
   b. house infestation and human infection rates
   c. community preparation/education

      i. Local health committees
      ii. Local health representatives

   d. health brigades

      i. 1 brigade per province
      ii. 7 members per brigade: physician, nurse, laboratory technician, driver and 2 insecticide application technicians

2. Attack

   a. insecticide application (deltamethrin)
   b. house improvement
   c. education
   d. clinical assistance

3. Consolidation

   a. program maintenance and cooperative efforts among health brigades, local health committees and local health representatives
   b. surveillance

4. Evaluation

   a. house improvements completed
   b. changes in infestation and infection rates.

*from reference g

Tarija

Located in the same general area of Bolivia as Tupiza, Tarija lies to the east at an altitude of 1,866 meters above sea level. Government-sponsored Chagas' control programs in this region have been limited to one-time urban and peri-urban applications of the insecticide (BHC).(b,e) A more well-developed program, sponsored by CARE, is underway in the Canasmoro area north of Tarija city. Known as Proyecto Nuevo Amanecer, it is a community-level program involving some 180 households. Although fumigation and house improvement are included in its plan, these aspects are part of a broader health and development program that includes economic development, provision of latrines and potable water, and impressive community organization. This project is notable in that it appears to have successfully incorporated a viable Chagas' control program into a broader health and development project. Its Chagas' control efforts, however, have not been critically evaluated and it is unclear whether or not appropriate baseline data were obtained.

Poorly funded and equipped malaria/*Aedes* government control teams are present in this area, but have had limited activity. Such teams could provide the beginning of an infrastructure for a combined vector-control strategy in Tarija. Physicians and scientists at the newly constructed, well-equipped Hospital San Juan de Dios have conducted serologic and electrocardiographic studies, the results of which are described in chapter 4 of this document. Unfortunately, there has been little interaction or collaboration between hospital staff and the individuals working in epidemiology and preventive health.

Sucre

Sucre, the capital of Chuquisaca Department and official capital of Bolivia, is located in south central Bolivia at an altitude of 2,790 meters above sea level. Its climate is temperate and it is surrounded by the valleys typical of this region. As in Tarija, the government maintains a limited malaria control program, but both its activity and efficacy are minimal. There is no government-sponsored Chagas' disease control effort in effect in this area.

Two PVOs are active here: Foster Parents' Plan International (PLAN) and Proyecto Social Boliviano Britanico "Cardenal Maurer" (PSBBCM, or Proyecto Britanico). PLAN's activities include a training program for rural health representatives, community education programs, provision of latrines and potable water, and house improvement. The latter, however, appears to be limited to

families with "foster parent" sponsors and therefore is not an effective means of Chagas' disease control. Expansion of house improvement efforts to a community-wide program or integration with other PVO or government house improvement projects could be readily accomplished, making a significant contribution to Chagas' control in this area.

Proyecto Britanico (n) began its Chagas' control project in 1988. Although the program is supported by the British Overseas Development Administration and Catholic Relief Services, approximately 67 percent of its operating budget is provided by the participating local communities in the form of local materials and labor. The program is based on a high level of community commitment and participation and consists of five basic phases: education or increasing local awareness, baseline data gathering, household improvement (including surrounding compound and domestic animal dwellings), insecticide application, and evaluation. Details of these five phases are outlines in Table 2.

The Proyecto Britanico is currently small in scope. Although the group is active in the three zones of Yotala, Tarabuco and Yamparaez and serves some 200 families in approximately 15 to 20 communities, the project has progressed to phases 3 and 4 in only two communities. Several others, however, have completed phase 1 and are ready to progress to phases 2 and 3.

An interesting additional component of the project is the simultaneous economic development that is occurring in at least one community. In order to increase the availability of construction materials for house improvement, Proyecto Britanico has taught community members how to manufacture ceramic roof tiles. The beauty of this concept is that one community is now marketing this important product in other nearby communities, enhancing economic development while improving public health. Despite its small scale, the Proyecto Britanico is probably the best conceived and executed Chagas' disease control project that we visited or are aware of in Bolivia. If its evaluation phase documents success (as we suspect it will), the strategies and techniques used here will certainly provide helpful guidelines for any national control efforts.

The Centro de Investigacion y Diagnostico de la Enfermedad de Chagas of the Universidad Mayor, Real y Pontificia de San Francisco Xavier, is also in Sucre. Data obtained from this center have been incorporated into the chapter 4 of this report. As in Tarija, we saw little, if any, interaction between this center and groups active in Chagas' disease control in Sucre.

Table 2
Proyecto Britanico: Chagas' Disease Control Programa

1. Education or "consciousness raising"

   a. rural health professors - mobile
   b. lectures, films, social dramas in native dialect
   c. use of radio and television where practical

2. Baseline data gathering

   a. map and census of each community
   b. field teams (physician, nurse, laboratory technician, sociologist-educator, driver)
   c. house construction; house infestation rates
   d. *T. infestans* infection rates

3. House/compound improvement

   a. 2 construction specialists/teachers per community

      i. roof and ceiling specialist
      ii. wall and floor specialist

   b. PMA assistance - food incentives
   c. 3 phases - standardized techniques

      i. roof improvement
      ii. exterior house and surrounding structures improvement
      iii. interior house improvement

4. Insecticide application - per field teams and community

   a. two-phase spraying with deltamethrin
   b. instruction of community members in proper use of insecticides

5. Evaluation

   a. reassess household infestation rates
   b. community-directed surveillance
   c. repeat insecticide application as needed

Santa Cruz

Santa Cruz is a major urban population center located in the lowlands of central, eastern Bolivia at 416 meters elevation. Although Chagas' disease may not be quite as prevalent in this areas as in others we visited, it is certainly endemic to various rural areas around Santa Cruz. Vectors of malaria, dengue, and yellow fever (*Anopheles* and *Aedes* sp) are also highly prevalent in this region. Vector control activities have emphasized *Anopheles* and *Aedes*; no Chagas' disease control program is operating at this time. The local SNEM (Servicio Nacional de Eradicación de Malaria), however, has *Aedes*/malaria control teams and a functioning entomological laboratory that could be adapted for Chagas' disease control in an integrated vector control program.

The laboratories of CENETROP (Centro Nacional de Enfermedades Tropicales) also are located in Santa Cruz. Unfortunately, serious cuts in funding have limited current activities to primarily diagnostic and training services. The former stature of this respected research facility is in grave danger and there is little hope for resurrection without renewed funding. CENETROP has produced excellent data on Chagas' disease, which are summarized at various points in chapter 4.(8,11,13) CENETROP has one study ready for initiation and two awaiting completion, but all are in jeopardy due to funding cutbacks. The proposed study in question is an elegantly designed, low-cost prenatal screening program. Programs underway and not likely to be completed without renewed funding are a blood donor seroprevalence (*T. cruzi*) study and a longitudinal (in its tenth year) clinico-epidemiologic study of Chagas' disease.

The combined presence of CENETROP and competent SNEM *Aedes*/malaria control teams provides an outstanding opportunity for developing both vector-borne disease research and control programs.

Aedes control activities in Santa Cruz have been augmented recently as a result of the current outbreak of sylvatic yellow fever. In the Department of Santa Cruz, eight deaths (six confirmed pathologically) were reported in the month prior to our visit. Local health officials are appropriately concerned about two important issues regarding this outbreak. First, *Aedes* household infestation rates in and around Santa Cruz have reached levels of 18 to 35 percent and the risk of a shift from sylvatic to urban yellow fever exists. Second, this outbreak is occurring in the context of a reasonably well-vaccinated (90 percent) local population and appears to involve almost exclusively unvaccinated/non-immune immigrants from higher elevations. In an effort to control this problem, mass

vaccination campaigns are underway that include the use of road blocks to ensure that unvaccinated immigrants receive vaccination. In addition, *Aedes* surveillance and control efforts along major highways and railroads have been increased.

Cochabamba

Located approximately 250 kilometers southeast of La Paz in central Bolivia, Cochabamba lies at an altitude of 2,558 meters above sea level. It is in the heart of Bolivia's central valleys and its surrounding areas have some of the highest *T. infestans* infestation rates in the country. Although one local house modification study was initiated as a collaborative effort of ORSTROM, IBBA and the Universidad Mayor de San Simon (UMSS), this project was marginally successful and now there are no organized control projects in the region.

The UMSS Faculty of Science and Technology has published numerous studies about clinical and epidemiologic aspects of Chagas' disease in this region (see chapter 4) and has plans for future studies. The faculty of Science and Technology also has a well-equipped laboratory designed for Chagas' disease research. There appears to be open communication and interaction between the Faculty of Science and Technology and the Faculty of Medicine. The latter runs a diagnostic support center that has also produced reliable research in the area of *T. cruzi* seroprevalence (chapter 4).

Evidence for collaborative efforts between these departments is seen in their proposal for a tropical medicine research center (see Annex E). This proposal calls for an integrated approach to the clinical, epidemiologic and basic research aspects of the various tropical infections in the region and is worthy of external financial and technical support. Previous and ongoing research by UMSS scientists attest to their ability to produce competent and useful research. If funds are available to support further studies here, there is little doubt that these groups will make significant contributions to the advancement of Chagas' disease control efforts.

The National Entomology Laboratory is also located in Cochabamba. Unfortunately, we were told that "personnel problems" had prevented collaborative projects between this laboratory and UMSS or the local Unidad Sanitaria. We were unable to visit the facilities.

As in Santa Cruz, *Aedes* control is a priority in Cochabamba, particularly in the Chapare region. Surveillance is occurring in some 24 communities (four of which are positive for *Aedes* infestation) and a control effort based on source reduction, larvicide use and education is underway.

Additional comments

In addition to the existing Chagas' disease control programs described in the preceding pages, we were informed of several completed and planned projects. These are summarized in Annexes C and D.

Finally, it is clear from the information presented above that there are or have been numerous "islands of activity" in the control of Chagas' and other vector-borne diseases in Bolivia. This almost total lack of communication and interaction has resulted in considerable waste and inefficiency. Open communication and coordination of research and control efforts must be implemented expeditiously if the profound deficits in funding, personnel and technical capability are to be overcome. In our last meeting at MPSSP, the Director General of Health requested that the Department of Epidemiology immediately begin to strengthen communication and coordination between all parties working with Chagas' disease in Bolivia.

6. Discussion and Conclusions

Control of Chagas' and other vector-borne diseases in Bolivia will require careful evaluation and implementation of strategies for house modification, insecticide application, community health education, blood donation and maternal-fetal health.

Housing Improvement

The housing projects visited indicate that progress in this aspect of control is possible in Bolivia. However, more study is needed to determine the best way to use inexpensive, locally available or natural building materials in construction, assess the durability of modifications, understand the roles of reservoir hosts (both domestic and sylvatic) and sylvatic vectors, and determine whether house modification alone can provide a triatome-free environment. (1,3,4,14,15,16)

Housing is similar within the endemic areas visited. In some areas, straw was used for construction, but in the majority, household walls and compound fences were made of adobe brick. The brick was either left bare or covered with smoothed mud ("reboque"), plaster or cement. Roofs were usually constructed with a mud-cane combination and covered with straw and thatch. Others were of tile, zinc or cement fiber. Inside, roofs were left "as is" or hidden by ceilings made from feed/grain sacks. Occasionally, they were covered with plaster.

Variations in wall surfaces, roofs and ceilings will have to be taken into account when insecticide application strategies for vector control are developed. However, the overall similarity of the house-compound complex throughout the endemic areas visited would make pilot projects designed to compare insecticide use feasible in all areas except those in the immediate vicinity of Santa Cruz city.

An example of such a pilot project is that proposed by TDR,(i) which is designed to compare an insecticide-impregnated paint, canisters for home fumigation and traditional residual insecticide applications.

Insecticide testing

Any field trial should begin with laboratory confirmation of the efficacy of the product against local vectors under local climatic and ecologic conditions. Test plates of the various building materials should be used for bioassays of the products under investigation. The efficacy of the products should also be tested against local anopheline vectors of malaria.

There has been one field trial using fenitrothion in Bolivia. Through a cooperative agreement with Argentina, some fenitrothion and deltamethrin were used in endemic areas of the frontier between the two countries. Synthetic pyrethroids seem to be the insecticide of choice and at least two different products have been used. Some BHC that was donated by Brazil is on hand, but its efficacy has been questioned. This product requires further chemical evaluation by CDC or another laboratory. Any insecticide considered for widespread use should be tested against local vector species. If problems at the National Entomology Laboratory in Cochabamba are resolved, it would be the logical site for such testing. CENETROP or the Universidad Mayor de San Simon are possible alternative sites.

Health education

House modification and insecticide application strategies will not be successful or sustainable without a corresponding community-level education program.(16) The infrastructure needed to mount large-scale community participation and education campaigns, or even small pilot projects in some areas, does not exist in Bolivia. Some information on Chagas' and other vector-borne diseases is included in the school curriculum, but theses diseases do not receive the attention they warrant. Most communities lack local health committees, health promoters, mothers' clubs, health posts or other local institutions that could serve as a nucleus for health education. There does not seem to be a viable system for training rural teachers in health other than those involved solely in classroom teaching. Thus, the potential for enlisting widespread community involvement is being missed.

Blood transfusions

Research into the role of blood-transfusions and congenital transmission in Chagas' disease in Bolivia is in progress. However, the magnitude of these problems has not been adequately addressed.

Hematogenous transmission via blood transfusions is a growing problem because increasing numbers of people from rural endemic areas are migrating to urban areas, where they provide a significant proportion of the blood available for transfusion. In many cities, the residents of the low-income, urban-rural fringe have dwellings infested with triatomes. It is often this population that seeks additional income from the sale of blood.

Very few hospitals or health centers test donated blood for *T. cruzi* and blood is rarely, if ever, held long enough to be treated with gentian violet. As the blood banks in Bolivia become more sophisticated and the use of transfusions increases, the number of transfusion-associated cases of Chagas' disease can also be expected to increase. Studies of blood donors already completed in some urban areas reveal an astounding seroprevalence of over 70 percent.

Epidemiology

There are few epidemiologic statistics on acute cases, chronic morbidity, and mortality from Chagas' or other vector-borne diseases in Bolivia.(a,8,10,11,13) However, various field surveys have demonstrated house infestation rates (*T. infestans*) and captured *T. infestans* infection rates (*T. cruzi*) indicating that Chagas' disease is probably one of the most important public health problems in the country. Serological surveys of rural villages, pregnant women, newborn infants and blood donors show seropositivity rates much higher than those seen in most other endemic areas. Moreover, the pathological manifestations of Chagas' disease in Bolivia tend to be more severe and widespread than those in other Latin American countries where vector control programs, improved living conditions and blood bank surveillance/treatment programs have led to significant reductions in morbidity and mortality.

Control efforts

The government of Bolivia has no functioning national Chagas' disease control program, nor does it have the potential to mount such a program without substantial external financial and technical support. Even existing programs for *Anopheles* and *Aedes* control are operating with dangerously marginal efficacy with limited financial support from P.L. 480 funds. Although various small Chagas' disease control projects have been initiated, these projects have not been in operation long enough for critical evaluation, have been poorly evaluated, or lack appropriate data for evaluation.

Proposals for national and regional control programs have been written, but are inoperative due to too few and inadequately trained personnel and lack of funding. These proposals are similar to traditional malaria control campaigns that emphasize house spraying with residual insecticides by government spray teams. Although education and house modification are included in these plans, the government considers them too slow and costly to be given a high priority. Vertically-structured spraying strategies may indeed produce the most immediate results, but in the long run, such programs are expensive and their sustainability is dependent upon a continuous source of external financial aid.

PVOs, working either alone or with the Ministry of Health, have demonstrated that communities in rural Bolivia can be organized to participate in house modification, education, residual insecticide spraying and other health-related activities, but it is too soon to determine whether this work will continue after the external influence is withdrawn. It is clear, however, that a local health infrastructure must be in place before significant progress can be made to prevent or control Chagas' and other vector-born diseases.

Need for coordination

Although committees, workshops and other means of project coordination seem to have been attempted at various times, the success of these at the national and regional levels is questionable at best. Little communication seems to occur between the various projects or even within government agencies with potentially common goals (e.g. Ministry of Health, Ministry of Education, and Ministry of Housing and Urban Development). A very low level of awareness exists between government and private preventive and curative health services or between universities and research institutions and government-sponsored programs. Smaller, privately sponsored projects have been virtually ignored. These problems in communication and coordination have resulted in inefficiency, wasted time and resources, needless duplication of errors, and a lack of dissemination of information about successful approaches.

It is doubtful that another temporary committee or workshop is the answer, but improved coordination is essential if more widespread economic support for vector control through house improvement, education and insecticide application is planned.

Technical assistance needs

There are a number of areas in which both the VBC Project and CDC might continue to assist the Mission in strengthening efforts to control Chagas' and other vector-borne diseases. Among these would be assistance in preparing proposals for external funding for major control activities or for pilot projects and research grants. Short-term consultants to address specific technical questions or for program evaluation could be requested as the need arises. Specifically, CDC has expertise in epidemiology and laboratory assistance. The VBC Project could provide technical assistance in the epidemiology of vector-borne diseases, entomological studies and vector control, social-cultural-economic studies and the establishment of a computerized information system to organize, supervise, evaluate and cost a national control program.

The state of entomological work in Bolivia is poor. Many of the malaria zones have entomological auxiliaries, but they are not being fully utilized. Some had been temporarily assigned to other programs. Only Santa Cruz and Cochabamba had entomology laboratories and a functioning insectary. One problem seems to be a lack of understanding among the malaria zone chiefs about the duties and value of an entomological team. A potential remedy might be for the VBC Project to organize a short course for senior zone staff to learn more about the use of entomology in program planning, evaluation and decision making.

Bolivia has a national entomology laboratory and insectary in Cochabamba, but it has never functioned fully. We were told that the physical facilities are excellent, but we were unable to visit it. Recently, the director of the laboratory retired and a replacement was appointed. The time is ripe to recruit and train new staff for the laboratory. We were told that with the yellow fever epidemic in Cochabamba and Santa Cruz and the growing possibility of further dengue activity in Santa Cruz, there is a shortage of entomological auxiliaries. The actual need should be determined and the new staff trained at the same time. The VBC Project could be contracted to provide a consultant to help the new director prepare a national plan of action for the laboratory and the auxiliaries in each malaria zone.

7. Recommendations

1. A National Chagas' Disease Control Project should be established within the Dirección Nacional de Epidemiología of MPSSP and funded for a period of 10 years with provision for additional funding during surveillance.

   Rational: Chagas' disease is the most important vector-borne disease problem in Bolivia. House infestation by the vector reaches 100 percent in many rural endemic areas. The overall seropositivity rates for the country are the highest in the endemic range of the disease. Serological surveys of donor blood in hospitals show rates over three times higher than from other countries. Morbidity and mortality, although not well documented, appear to be higher than in Argentina, Brazil and Venezuela, where vector control programs exist. National control programs in these countries have clearly demonstrated that seropositivity can be reduced by chemical control.

   The MPSSP has developed a national- and regional-level plan of action that is realistic, but requires minor alterations. Long-term funding is required because vector control, house improvement and education are slow to show results, but the combination should be sustainable. Additional funding for project surveillance is recommended because a sylvatic cycle of *T. cruzi* exists and vectors of this cycle are capable of colonizing houses.

2. A number of bilateral and multilateral technical assistance agencies should be approached for financial and technical support due to the magnitude of the problem and the length of time in which aid will be required.

   Rational: Donor support organized to address a simple preventable disease can have a tremendous impact upon the quality of life in a country. Chagas' disease is an important local/national health problem ignored by many international organizations, which tend to use global estimates of prevalence to determine disease priorities. As a result, sufficient funding to cover all aspects of the project may not be available from a single agency. Many aspects of Chagas' disease control, such as health education, may already fit into educational programs like those of UNICEF. Blood bank surveillance and treatment programs, as well as screening of pregnant women and treatment of infected newborns, may fit existing child survival projects. It is suggested that USAID/La Paz and PROCOSI serve as a catalysts

to bring the various bilateral and multilateral agencies together and provide them with the information required to seek funding through their respective agencies.

3. External funding of the National Chagas' Disease Control Project will require careful coordination and should include provisions for consultation and routine project evaluation. Consultants are necessary to assist the MPSSP in project planning, supervision and evaluation and for specific technical problems.

   Rational: The Department of Epidemiology has developed a national plan of action leaning towards a vertically-oriented insecticide control program. Experience is lacking in health education and house improvement, as well as the social, cultural and economic aspects of control. Various PVOs, local research institutions and universities and donor agencies will have to provide prolonged technical assistance. Consultants should be available when needed and at least one specific consultant or group should be available for short-term consultations throughout the 10-year life of the project to ensure that standard goals and methodology are used and to limit technical confusion.

4. A National Chagas' Control Project should be based upon a combination of insecticide application to houses, outbuildings, fences and corrals, house-compound improvement, and sanitary education. All components should encourage maximum community participation.

   Rational: Residual insecticides can control triatomes, but the process takes a long time. House spraying by organized government teams is expensive. Labor, transport and administration costs may equal or surpass the cost of insecticides. The combination of such costs is not sustainable. Therefore, house improvement and sanitary education must eventually replace most residual spraying, but to become cost-effective, the majority of the duties and costs are transferred to the community. Existing PVO pilot projects can provide information and guidance on developing a appropriate prospectus for the role of housing and education. An analysis of existing information from these projects could provide construction norms and costing data for the government plan of action. The MPSSP Department of Epidemiology, working with PROCOSI, should seek the cooperation of the PVOs in this part of the project. A consultant might be required to assist in developing the national plan.

5. USAID/La Paz should seek financial support at a level of US$ 50,000 to 100,000 for the MPSSP Department of Epidemiology to investigate new control strategies following the WHO/UNDP/WB TDR protocol.(i)

   Rational: The TDR protocol provides a guide for evaluating insecticide-based paint and a fumigation canister as alternatives to residual spraying. Different countries in the Chagas' disease-endemic area use different house construction materials and design; consequently, a number of trials are needed. In a national plan of action, the insecticide-based paint could be used for ceilings and walls inside of houses at the time of house improvement and the fumigation canister to control isolated foci of infestation due to invasion by sylvatic-peridomestic vectors. It is suggested that the evaluation be done in cooperation with PVO house modification projects. Otherwise additional expenses would be involved in improving the walls for painting and modifying windows and doors for fumigation.

6. The National Chagas' Disease Control Project should be integrated with other vector-borne disease activities in the area.

   Rationale: Duplication of work is an added expense to the government. Therefore, integration of vector-borne disease control measures should be built into a national plan of action. The chemical control strategies against anopheline mosquitos and triatomes are similar. Insecticide susceptibility testing against both vectors will be necessary to select a common insecticide. General sanitary practices and cleanliness can reduce anopheline, *Aedes*, *Culex* and triatome breeding and colonization sites. House improvements such as screens on windows and doors provide barriers for most flying insects. It is understood that certain aspects of each control approach might not be applicable to overall vector control, but individuals can be trained to perform a number of control measures, reducing the total cost of the operation.

7. A system of providing interest-free loans for rural house improvement is recommended to perpetuate the housing component.

   Rationale: The Proyecto de Desarrollo Agropecuario "Cotagaita San Juan del Oro" (FIDA) and some of the PVO projects have such a system. Similar systems for loans, such as Viviendas Rurales in Venezuela, are found in other countries. A method for obtaining loans would speed up the house improvement component and provide a flow of money to expand it. Development banks such as IDB and World Bank could be approached

or the government could establish a system. Economic consultants are required to provide guidelines and administrative details.

8. A National Chagas' Disease Control Project can begin at a regional level, but it is recommended that initial chemical control be as widespread as possible. Education and house improvement could begin on a small scale and be expanded gradually.

   Rationale: Funding for all components of the project for the entire endemic area may not be practical at the beginning. Agencies may be willing to increase support once the project proves its effectiveness. The logistics of mounting a nationwide campaign for house improvement and education in the formidable terrain of most endemic areas is beyond the present capacity of the government. Research and development within these components are required. A small-scale beginning in the most seriously affected areas would allow for changes in strategy and more effective development of the project.

9. The National Chagas' Disease Control Project should attempt to incorporate the recommendations of the recent WHO Expert Committee on Chagas' disease, whenever possible, into its strategy.

   Rational: Although the Expert Commitee report is not yet available, it should be before a national plan of action is developed. The report outlines aspects of patient treatment, especially of newborns, blood bank norms and other important issues that are not covered in detail in this concept paper. WHO could be contacted to provide expert advise if it is needed.

10. A permanent coordination committee with membership from MPSSP, the Ministry of Education, USAID/La Paz and other donor agencies, PROCOSI/PVOs, universities, major hospitals and research institutes should be established.

    Rational: Coordination is an essential element in dealing with Chagas' disease control. Many groups work in isolation and information flow is inadequate. Each group has something to offer. A committee could also help promote and educate the public and government personnel about Chagas' disease and its prevention and control. This function will eventually make funding easier. The Department of Epidemiology should initiate this committee and be the focal point. One of its staff should be the permanent secretary. If possible, the president of the committee should be a government minister.

11. A center to train rural professors of health for adult education and health promotion should be developed and a consultant requested to prepare curriculae and didactic materials.

    Rational: Projects operating in Tupiza and Sucre use a system of rural professors of health and RPSs (local health representatives) for health education. Most of these individuals have been educated in Chile or Argentina because facilities do not exist in Bolivia. Our limited observations indicate their responsibilities should go beyond vector-borne diseases while maintaining emphasis on the components of the national plan of action for vector control. These individuals also need training in other elements of primary health care and in community participation. The Ministry of Education and other agencies dealing with education must be involved. Since the function of the rural professor falls into primary health care, a donor with priority in this field should be approached.

12. Laboratories performing Chagas' disease diagnosis need coordination and a system of quality control. Many of these laboratories also deal with dengue, yellow fever and malaria diagnosis. Norms for all laboratory diagnostic procedures must be established.

    Rationale: Facilities for serological diagnosis of Chagas' disease are found in PVO projects, private clinics, regional hospitals, universities, research institutions and donor-supported agricultural development projects. There are a number of different serological tests being used with little or no supervision, quality control of antigens or reagents, norms for interpretation of results, or correlation of data. A consultant from CDC or the WHO Chagas' serology reference laboratory could assist in establishing a diagnosis system, norms and evaluation procedures.

13. The National Entomology Laboratory at Cochabamba and regional laboratories in the malaria zones should become functional.

    Rational: For many years, the National Entomology Laboratory has functioned in name only. During this time, insecticide resistance to DDT in *Anopheles* and to malathion and temephos in *Aedes aegypti* has been reported, but not confirmed. If resistance is present, the efficacy of some control operations must be questioned. The role of entomologists in program evaluation, research and development, and confirmation of control strategies is essential to cost-effective control

operation. The entomological network exists, but a plan of action and a process of network strengthening are necessary. A consultant from the VBC Project or PAHO should be asked to work with the director of the laboratory to develop a plan of action and determine needs.

14. Ways should be investigated to assist the Universidad Mayor de San Simon, Cochabamba, to establish a Centro Universitario de Medicina Tropical.

    Rational: A plan of organization, including a budget already exists. Basic staff and facilities are in operation as parts of different institutions. The objectives are different from those of CENETROP in Santa Cruz and the Center brings considerable university expertise into Chagas' and other vector-borne disease research. USAID/La Paz, the VBC Project and CDC should explore the interest of a U.S. research institution or university in entering into an agreement with UMSS for mutual research and development.

15. There must be a research and development component within the context of a national vector-borne disease control program.

    Rational: Operational and basic research is essential in disease control. Such a component facilitates cooperative investigation with agencies such as CDC and provides a means for the program to solicit funding from PVOs, USAID/La Paz and TDR. Research is essential for standardizing immunodiagnostic techniques, developing direly needed treatments for chronic Chagas' disease, and increasing our understanding of host-vector-parasite interactions.

8. Literature and Documents

Documents

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b. Ministerio de Prevision Social y Salud Pública, Direccion Nacional de Epidemiología. Proyecto Control de la Enfermedad de Chagas' en el Departamento de Tarija, Bolivia. Febrero, 1989.

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9. Itinerary

Chronology of the trip (February-March 1990)

February

23 Meeting at the VBC Project
Visit to PAHO

26 Meeting with A.I.D. and VBC staff
Dr. Bryan to Bolivia

27 Dr. Bryan meeting with USAID/LA Paz staff
Dr. Tonn meeting with VBC staff
Dr. Tonn to Bolivia

28 Briefing at USAID/La Paz Child Survival Project

March

1 Briefing at the Department of Epidemiology
Briefing at USAID/La Paz, Child Survival Project

2 Briefing at PROCOSI
Briefing at the Department of Epidemiology

3 Trip to Tupiza

4 Field observations: Characato, San Miguel, Salo La Torre, Tambillo Bajo and Palala Alta

5 Meeting at Tupiza, Unidad Sanitaria
Meeting at FIDA, Chagas' disease project
Field observations: Oploca, Torre Huayco and San Joaquin

6 Field observations between Tupiza and Villazon and between Villazon and Tarija

7 Meeting at Tarija, Unidad Sanitaria
Meeting at San Juan de Dios Hospital
Meeting at CARITAS-Tarija

8 Field observations: Guayavillas, La Merced, La Marmora, Chaguaya (CARITAS Project site), Concepción and Barrio Libertad in Tarija

March

9 Field observations: San Lorenzo/Canasmoro

10 Discussion of protocol of Dr. Ciro Figueroa
Trip to Sucre
Briefing at Plan International-Sucre

11 Visit Hospital-PSBBCM, Yotala

12 Briefing at SNEM, Sucre
Briefing at Unidad Sanitaria, Sucre
Briefing at Proyecto Social Boliviano - Britanico "Cardenal Maurer"
Briefing at Centro de Investigación y Diagnosis de la Enfermedad de Chagas
Visit Palomano and Tambo (Zone I, PSBBCM)

13 Trip to Santa Cruz
Meeting with Department of Epidemiology and SNEM staff

14 Briefing at Unidad Sanitaria, Santa Cruz
Briefing at Malaria Office
Briefing at CENETROP
Field observations: La Elvera and Sombrerito

15 Field observations:
Santa Cruz: Santa Fe, Yapacaní, Villa Busch, Km. 21
Cochabamba: Bulo-Bulo, Tres Pacos, Ivirgazama

16 Briefing at Unidad Sanitaria, Cochabamba
Briefing at Hospital Gastroenterológico
Briefing at Facultad de Biología, UMSS
Briefing at Facultad de Medicina, UMSS

17 Field observations: Cochabamba urba-rural fringe, Apita, Tarata and Cliza

18 Return to La Paz
Drafting report

19 Roundtable discussion with PVOs (PROCOSI)
Briefing at USAID/La Paz Child Survival Project

20 Meeting at USAID/La Paz Office

March

21	Briefing at Department of Epidemiology Drafting report
22	Drafting report Meeting at MPSSP, National Director of Health
23	Meeting at Department of Epidemiology Return to USA
24	Review report manuscript
26	Debriefing at VBC
27	Review report manuscript

List of Persons Contacted

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Tec. José Luis Chambi, Supervisor Técnico

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Annex A

House Improvement Guidelines

1. **Points for Consideration**

   a. Organization of the community

      1. Establish field teams, including health educator, doctor and/or nurse, house inspector, entomological evaluator and driver. Adequate transportation is essential.

      2. Establish community health committees and mothers' club and/or work within existing community administrative structures.

      3. Map village, number houses, obtain family-dwelling data, and divide into sectors of 5-10 houses. Have each sector appoint a leader. The leaders could form the health committee.

      4. Develop a system of interest-free loans for improvement costs and a system of repayment.

      5. Enlist entire community in program. Must have near 100% cooperation to eliminate sources for triatome reinfestation.

      6. Appoint or have community elect a local person and train the individual for coordination, supervision, evaluation and surveillance (a focal point), and establish lines of communications with local program manager (district, area, etc.)

   b. Coordination

      1. If possible, coordinate work with other projects such as potable water or alternative economic development.

      2. Set up village center for training construction and modification procedures. An outside expert will be needed for training and technical supervision of work.

      3. Attempt to establish "cottage industries" in the area to manufacture window and door frames, roofing materials and adobe bricks. Use low cost local building materials whenever possible.

2. Stage I. Technical preparations

a. Map the community, grade houses as to condition and type of modifications necessary. Estimate time required and cost of modification. Discuss with occupant the cost and method of loan repayment.

b. Inspect house and compound for triatomes and do parasitological examination of them for *T. cruzi*. At this stage, man-hour or similar collections should be made, noting the location of triatomes (bedroom, kitchen, animal shelter)

c. Schedule time for modification by sector. It is best to schedule work when people are not busy farming and/or during dry season.

d. Intensive education programs to point out that house improvement alone will not solve problem. Must keep house and outbuildings clean because a single focus can reinfest the entire community.

e. Laboratory susceptibility tests should be done before insecticide is selected. Treat entire community (house, fences, outbuilding, corrals) with long residual insecticide (synthetic pyrethroid, i.e. deltamethrin or fenitrothion).

   1. Can be done by SNEM brigades.
   2. Can be done by local people under supervision.
   3. Safety precautions must be observed.
   4. In malarious areas, an insecticide effective against triatomes and anophelines should be used.

3. Stage II. Process for modification

a. All buildings have to be modified to a level that triatomes cannot colonize. Weak points are:

   1. door-window frame joints with walls;
   2. corners of roofs and walls;
   3. undersurface of roofs;
   4. areas of walls subject to cracks;
   5. fence around compound;
   6. all animal shelters, especially those holding rabbits, guinea pigs and chickens.

b. Begin with house roof. Check wall to ensure that it can support weight of modified roof. Cement fiber, metal or tile roofs are better than natural products. If mud, stone or other building material are used, the inner surface must be sealed with plaster.

c. Some areas of the country use "tumbados" (false ceilings made of plastic-coated cloth). The tumbados must not have any opening large enough for a first instar nymph to pass. Impregnating the cloth with a residual synthetic pyrethroid or utilization of an insecticide-impregnated paint, e.g. chlorpyrifos-based paint, should be tested.(17)

d. House and all other walls must be smooth inside and outside. No cracks, especially around joints, should be left. In malarious areas, windows and doors should be screened. If proven cost-effective, insecticide-based paint might be considered for wall and roof surfaces inside the house.

e. Replace dirt floor with cement.

f. Further research is necessary on placement and design of chicken, rabbit and guinea pig pens. They should have a solid roof to prevent colonization and be placed a few feet above the ground. Animal shelters and fences must be improved to a degree similar to the house.

g. Upon completion of compound, inspect for potential sites for triatome colonization. Repair before work is certified completed.

h. Continue sanitary education on reduction of resting-hiding places of bugs (boxes and bags of clothes, pictures on the wall, religious shrines, etc.). Consider residual insecticide applications to back of pictures and calendars and barriers when hanging clothes. In urban and urban-rural fringe, include source reduction for *Aedes aegypti* in the education.

4. Stage III. Second insecticide treatment

a. If insecticide-impregnated cloth or insecticide-based paint are not used or where animal shelters and fences remain positive, use a residual insecticide a second time (wait for this treatment until entire village or isolated compound is complete)

b. Treat entire village at one time. Subsequent treatment should be directed only towards positive foci. Attempt to further improve any foci. The RPS should evaluate and follow up all treatments.

c. Use same insecticide as in pre-house modification or, if shown to be cost effective, the Argentine canisters for fumigation might be considered.

d. Inspect by human time-limited collection or use Maria Sensors to evaluate the effectiveness of insecticide treatment.

5. **Stage IV. Surveillance**

a. If one is not already in operation, establish a surveillance post or identify an individual responsible for evaluation (local nurse, teacher, RPS, or member of the health committee). Duties should include confirmation of presence of triatomes, including identification of species, inspection of all positive premises, authorization and/or supervision of additional house repairs or insecticide spraying, and recording household information, exact site of colony and date of treatment-modification.

b. Schoolchildren and adults should be trained to recognize and collect triatomes in the house and notify the responsible person.

c. Since in some areas, SNEM has voluntary collaborators, their duties could be expanded to routinely inspect all compounds and recommend repairs as needed. (There must be a method better than the one in place for malaria to serve these individuals.) Rural health educators could visit villages routinely to motivate and guide the community towards improved sanitation and upgrading compounds.

d. All new construction in a village or compound must fit the norms accepted to be free of triatomes. All permanently abandoned houses, fences, corrals and animal shelters should be completely destroyed.

e. Surveillance must be open-ended and contain some provision for external supervision and evaluation.

6. Program Evaluation

a. Compare pre- and post-modification triatome infestation by time-limited house examination (collect all triatomes) or Maria Sensors. Collections should emphasize the bedrooms.

b. Compare pre- and post- modification rates of triatomes infected with *T. cruzi*.

c. Compare pre- and post- modification seroprevalence rate in children and/or seroconversions in the general population. Data from a single village will not be sufficient to evaluate the projects, but if handled for a number of villages, it should be acceptable. It is calculated that it may take five years or more after modification is completed to show a significant drop in seropositivity.

d. Determine community acceptance and appraisal of the project.

e. Determine the type and amount of improvements made by individuals after initial modifications.

f. Assess overall economic development in the area.

g. Assess efficacy of educational program (sociologist, anthropologist, health educator).

h. Record immigration, migration, deaths, births, new houses and abandoned housing in area.

i. Determine cost of insecticides, educational materials, construction, surveillance and evaluation.

j. Determine success rate of loan repayment.

7. Costing of Project

The following is based upon costs of materials in Tupiza, Tarija and Sucre:

Item	Unit Cost	Number of Units Required
Estuco/plaster	Bs.* 5-7	6
Cement	Bs. 11	5
Zinc Roof Panels	Bs. 36	4-5
Cement Fiber Panels	Bs. 34	4-6
Tiles (adobe)	Bs. 270/1,000	1
Labor	Bs. 10/day	8.5 days
Grain sacks	Bs. 1.5-2.0	14

*U.S. $1.00 = Bs. 3.06 as of 3/24/90.

8. The role of house modification in a National Chagas' Disease Control Project

a. For wide coverage and immediate protection of the people, any national Chagas' disease program must start with a residual house spraying project similar to malaria.

1. Existing national plans for Chagas' disease control already cover the strategy and cost of such a program.

2. Insecticide treatments alone are not sustainable by the government.

3. If fenitrothion or deltamethrin are used in malarious areas where Chagas' disease is endemic, the cost of the spraying operation could be reduced by controlling two vectors with one insecticide. Evidence from Brazil indicates that the more expensive synthetic pyrethroids are cost-effective because they require fewer spray cycles.

4. Since the cost of insecticide amounts to only a small proportion of a spraying operation, community-based labor should replace SNEM brigades.

5. Spray programs should be evaluated in the same way as house modification ones. Village-based evaluators can determine retreatments.

6. Except in malarious areas, after the initial insecticide application, only positive foci need be retreated. (Since many migratory workers live in shelters without walls, insecticide-impregnated bed nets should be considered. It was noted that bed nets were already in use in the lower elevations.)

b. The Chagas' disease-endemic area should be stratified

1. Urban-periurban areas: Health education, general sanitation, insecticide, house modification. Normally a low priority, but a source of *T. cruzi* infected blood for transfusions.

2. Plains and lowlands, especially areas with high humidity. Low priority for Chagas' but there are probably malaria-endemic areas. If epidemiological surveys indicate seropositivity greater than 10 percent, consider using an insecticide other than DDT for malaria control.

3. Dispersed housing in foothills and mountains. If roads are poor, consider insecticide treatment yearly with deltamethrin. (Check for effect of deltamethrin on local anopheline vectors.)

4. Grade endemic areas by:

   a. presence or absence of malaria, *Aedes*;
   b. amount of migration to and from area;
   c. stability of village housing, agriculture practice;
   d. rates of house infestation, triatome infection, seropositivity;
   e. interest in community and community administrative structure, including health centers, voluntary collaborators, health committees;
   f. villages vs. dispersed housing;
   g. morbidity and mortality statistics, when available;
   h. logistics for supplies, supervision and evaluation.

5. From above, determine areas to begin house modification.

   a. Begin modification on a small scale, either in one major political subdivision or in several, depending on finances and staff.

   b. Establish a vivienda rural loan system.

c. Review information from PVO and other house modification plans to develop strategy.

d. Assure long-term commitment of funds with the understanding that epidemiological evaluation may require 10 years or more to confirm value of project.

e. Select areas with high endemicity with a good potential for success.

f. Establish a protocol for house improvement, entomological-epidemiological evaluation, cost analysis and social-cultural consequences.

g. Houses in too poor a condition to be improved have to be destroyed and new houses built.

h. Care must be taken so the national project is consistent in its operation.

i. See above for health education suggestions.

   i. Establish a school to train rural health educators. (Plan International-Sucre has experience.)

   ii. Coordinate with Ministry of Education to upgrade teaching aids for all grades with greater emphasis on Chagas' and other vector-borne diseases.

   iii. Study Proyecto Britanico methodology for organization and motivation of community.

Annex B

Vector Control Needs

1. Problems

a. Personnel problems have existed in the National Entomology Laboratory and the Department of Epidemiology has not been able to fully utilize it.

b. Field staff have been assigned other duties.

c. Malaria zones do not have facilities for entomology laboratories nor equipment and supplies for field work.

d. Only routine *Aedes aegypti* and anopheline surveillance is being done. No research activities are planned.

e. There is a need to upgrade CENETROP and the Universidad Mayor de San Simon to assist in entomology. There is little coordination at present.

f. There is no national plan of action, resulting in limited awareness of needs.

g. There is a need to develop contingency plans for dengue hemorrhagic fever and urban yellow fever outbreaks.

2. Solutions

a. Assistance to help develop a national plan of action for a 5-year period including staff needs, training, routine work, research, coordination of field staff, information flow, budget (supplies, equipment, salaries, per diem, transportation, overhead and maintenance).

b. Establish a continuing education program for staff and new recruits. Include overseas training where needed. Coordinate with PAHO on training.

c. Establish a research network including universities, IBBA, CENETROP, Chagas' disease research institute and the Department of Epidemiology to coordinate, encourage and seek funding for Chagas' and other vector-borne disease research.

3. Some Research Needs

a. In many areas, the vector species of malaria is still unknown.

b. Continual study of distribution of all vectors.

c. Confirm exophilic-endophilic status of malaria vectors.

d. Confirm role of sylvatic *T. infestans* and other sylvatic triatomes, particularly the role of *T. sordida*, in the transmission of *T. cruzi* to humans.

e. Determine the status of resistance in anopheline vectors to DDT. Test resistance by species and map geographical distribution (WHO Test Kits and Procedure). If resistance is widespread, select an alternative insecticide (laboratory and field studies).

f. Determine the susceptibility of *Aedes aegypti* adults to malathion and larvae to temephos.

g. Use natural populations of *Aedes aegypti* to evaluate the efficacy of ground-mounted ULV equipment in the field.

h. Conduct tests on the potential role of insecticide-impregnated bed nets for malaria control and insecticide-impregnated cloth for ceilings or bed mats for triatome control.

i. Participate in TDR alternative insecticide strategy comparison.

j. Improve evaluation strategies for vector control (all vector-borne diseases).

k. Confirm sylvatic vectors and reservoirs of yellow fever.

l. Determine vector control strategies for contingency planning for disease emergencies, particularly for dengue hemorrhagic fever.

m. Refine guidelines for vector-borne disease stratification within the national vector control program.

n. Evaluate non-chemical means of vector control, particularly biological control and environmental management.

Annex C

Completed Chagas' Disease Control Projects

1. 1977 Fenitrothion field trial by CENETROP and MPSSP.

2. 1984 National or regional UNICEF-sponsored control program, no details available.

3. 1986 Collaborative Bolivian/Argentinian ministries of health insecticide application programs in frontier region near Tupiza/Tarija.

4. 1987 Deltamethrin trial in Tupiza.

5. 1987(?) IDB project in cooperation with Argentina to improve Chagas' disease serology and control in Tupiza/Tarija.

6. 1987(?) Small, local house improvement/education program by malaria control personnel in Sucre.

7. Plan International - Sucre had a Chagas' control program using malathion, but stopped because it did not control vector and cost too much.

Annex D

Proposed Chagas' Disease Control Projects

1. National	Ministry-produced national control strategy emphasizing vertically-oriented insecticide application program.
2. Tarija	Regional-level program of comparable design to that of national plan, but with somewhat more emphasis on education (Unidad Sanitaria - Tarija).
3. Tarija	CARITAS-sponsored local-level program in Chaguaya area; integrated approach combining community participation, education, house improvement, epidemiologic evaluation and coordination with Ministry of Health to avoid duplication. No insecticide application component.
4. Tarija	Local control proposal submitted by Dr. Ciro Figueroa, a cardiologist in Tarija, for the San Lorenzo area; program includes community education and insecticide application.
5. Santa Cruz	CENETROP: not a domestic control program, but an elegantly designed, inexpensive, practical prenatal screening program that includes Chagas' disease, contains guidelines for diagnosis and treatment of congenital cases.
6. Cochabamba	Local-level, Department of Biology, UMSS project; integrated approach utilizing epidemiologic evaluation, education, diagnosis and treatment, insecticide application and house improvement.

Annex E

Information and Research Needed

1. **Information on housing**

   a. Total number of houses in the rural endemic area.

   b. Extent of permanent and temporary migration to and from the rural endemic area; average time for temporary migrant and time of arrival and departure.

   c. Approximate number of rural houses abandoned and new house starts annually in the rural endemic area.

   d. Average cost in time and materials to build a new house or improve an existing one.

   e. Types of local building materials and type of modifications possible; average size of house and compound.

   f. Availability of building materials and expertise in local situations.

   g. General design of housing compounds in local areas and alternative designs; types and numbers of domestic animals.

   h. Results obtained through PVO and other house modification projects.

   i. Existing or planned house modification, sanitation, health education and other health-related activities in the endemic area.

   j. Value placed upon housing by rural families.

   k. Average life expectancy of a modified rural house and a catalogue of frequent defects noted and best approach to remedy each.

2. **Information on financial aspects**

   a. Multilateral and bilateral donors with an interest in Chagas' disease control and rural economic development.

b. Listing of all PVO's, small church groups, civic organizations and individuals active in or showing an interest in rural-periurban development.

c. The governmental input into Chagas' disease control as well as technical assistance from donors.

d. Average cost of insecticide treatment per house per year.

e. Cost-effectiveness of each control measure.

f. Ability of villagers to contribute in labor and money for house improvement.

g. The national and the Tarija Chagas' action plans are well-developed and the strategies are acceptable. The multidonor approach is excellent, but all parties concerned must be kept informed and their actions coordinated.

3. **Research**

a. Implement research following the TDR protocol to study new strategies of control of vectors for Chagas' disease. Consideration should be given to adding the variable house improvement without insecticide treatment to the list of experimental groups. This would increase the number of houses to 1,000. External financial support (US$ 50,000 to US$ 100,000) should be made available.

b. Results obtained from FIDA Tupiza project and from the various PVOs should be reviewed to determine research needs.

c. The Department of Epidemiology's capacity to do research is low. Consideration could be given to entering into an agreement with the Universidad Mayor de San Simon's Centro Universitario de Medicina Tropical or increase funding for CENETROP. Although there is a concentration of expertise, some financial support will be needed to expand the Centro. Consideration could be given for A.I.D. and the VBC Project to assist the Centro in contacting U.S. universities or government institution interested in tropical disease research.

d. A bibliography of all Bolivian publications should be compiled and distributed to all known investigators of Chagas' disease within the country. This should be continually updated.

e. Epidemiological studies are needed to determine morbidity and mortality in various areas of the endemic area; to determine the relative importance of blood transfusions in the transmission of *T. cruzi*, especially in urban non-endemic areas; and to determine the importance of congenital transmission in stillbirths-abortion, infant deaths and morbidity.

f. Existing national control plans place minor emphasis on health education, community involvement and house improvement. Specific research in each of these components will be necessary before they can become a viable part of the government program. Perhaps the best expertise in these fields as they related to Chagas' disease are found in Brazil and Venezuela.

Annex F

Proposal for Tropical Medicine Research Center:

Organizacion del Centro Universitario de Medicina Tropical

UNIVERSIDAD MAYOR DE SAN SIMON
FACULTAD DE MEDICINA
DIVISION DE INVESTIGACION Y EXTENSION
Cas. 992 COCHABAMBA

"ORGANIZACION DEL CENTRO UNIVERSITARIO DE MEDICINA TROPICAL"

Dr. Hernán Hermudez Paredes

Cochabamba, octubre de 1989
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ORGANIZACION DEL CENTRO UNIVERSITARIO DE MEDICINA TROPICAL DE LA FACULTAD DE MEDICINA DE LA UNIVERSIDAD MAYOR DE SAN SIMON DE COCHABAMBA

1. INTRODUCCION

La mayor extension del territorio de Bolivia en general y del de Cochabamba en particular, corresponde a la zona Tropical Oriental.

En el Depto. de Cochabamba, 2 provincias se extienden hacia esta zona: Chapare y Carrasco (mapa); en la primera desde hacen más de 10 años se inicio un proceso lento de colonizacion agricola por gente oriunda principalmente de los Valles;en la segunda(Carrasco)las actividades agricolas han sido recientemente (10 años) incrementada, su poblacion ha aumentado bruscamente como resultado de la conclusion de la carretera Cochabamba-Santa Cruz. Actualmente en ambos distritos existen numerosas localidades (concentracion de viviendas) con más de 200 habitantes ubicadas a lo largo de las carreteras Villa Tunari-Bulo Bulo y Villa Tunari-Moleto y a diferentes distancias a ambos lados de ambas vias (croquis 1).

La población estimada para 1988 para Chapare Tropical es de 40.000 y para Carrasco Tropical de 25.500 H.

Administrativamente, forman parte de Chapare Tropical:

a) Villa Tunari y áreas de influencia.

b) Chipiriri y áreas de influencia.

c) Localidades entre Villa Tunari y Chimoré y áreas de influencia.

Carrasco Tropical está conformado por: las localidades situadas entre Ivirgarzama y Bulo Bulo y sus áreas de influencia al sud y norte de la carretera.

La infraestructura sanitaria actualmente existente es:

- Chapare Tropical:

1 Hospital Distrital y 5 puestos medicos, 2 Hospitales privados, 8 médicos, 1 enfermera graduada y 16 auxiliares de enfermeria, 3 Odontólogos.

Carrasco Tropical:

1 Hospital Distrital, 5 puestos medicos

6 médicos, 1 enfermera graduada y 8 auxiliares de enfermeria.

II. ANTECEDENTES

En la zona tropical del país, varias son las enfermedades endémicas: algunas de ellas por su carácter de metaxénicas (Malaria, fiebre amarilla, Dengue, Leishmaniasis, etc.) seguramente ocupan un lugar primordial en importancia. De otras, propias de esta zona como las infecciosas bacterianas y micóticas junto a los accidentes por animales venenosos solo se conoce casos esporadicos. En todos los casos la falta de registros precisos imposibilita el conocimiento de la verdadera magnitud de cada uno de los problemas de salud propios del trópico.

Existen sin embargo, algunas comunicaciones que nos muestran que algunos de esos daños son un verdadero problema de salud humana actual:

- Arbovirosis (Fiebre Amarilla y Dengue): todo el área tropical del país es Area endémica donde se han registrado brotes epidemicos más o menos importantes (Vargas, 1986; Balderrama y cols., 1981). El ultimo brote fue registrado entre septiembre de 1988 y junio de 1989 en todo el trópico de Cochabamba, donde se registraron más de 100 casos con un 80% de letalidad (Registro de la Unidad Sanitaria de Cochabamba, 1989).
- Malaria: En el pasado como consecuencia de diferentes situaciones (principalmente migraciones), la malaria fue extendida a la mayor parte del territorio tropical y sub-tropical del país. Con las actividades de control del SNEM (Servicio Nacional de Erradicacion de la Malaria) se ha observado una reduccion de la zona endémica (Carnes, 1986); sin embargo, los movimientos poblacionales observados ultimamente en el país, han hecho que las áreas restringidas de malaria acusen una virtual expansion, detectándose brotes epidémicos en diferentes lugares; la ultima registrada fue en el área tropical de Cochabamba con más de [illegible] localidades afectadas entre noviembre de 1989 [illegible] de 1990 (Cabildo, Informe de Brote).

- Leishmaniasis: la forma visceral parece estar restringida a los yungas de La Paz, sin embargo, no se han realizado estudios en otras áreas. Por otra parte, toda el área tropical es tambien zona endemica de la forma tegumentaria (Recarochea, 1983; Bermudez y cols., 1987; Desjeux y cols., 1984) con una prevalencia apreciable de complicaciones mucosas (De Muynck y cols. 1978).
- Parasitosis intestinales: principalmente por ancylostomideos, con prevalencia alta (Uriel y cols, 1982 y 1984), son tambien un problema casi general entre los habitantes del trópico y sub-trópico.

Existen en el pais instituciones creadas con objetivos similares, ellas son:

- CENETROP, en Santa Cruz, con el objetivo fundamental de realizar estudios epidemiológicos en Enfermedades Tropicales; la mayor parte de sus estudios estuvieron dirigidos a determinar la magnitud de la Enfermedad de Chagas y Leishmaniasis en el Departamento de Santa Cruz. (Boletines del CENETROP).
- IBBA, en La Paz, cuyo objetivo principal es el de estudiar problemas humanos relacionados con la altura; sin embargo, investigadores de ORSTOM (Francia) realizan tambien estudios en diferentes aspectos relacionados con parasitosis del trópico y sub-trópico como Chagas y Leishmaniasis.
- SNEM, dedicado exclusivamente al control de la malaria en el pais.
- Servicio de Fiebre Amarilla, actualmente dependiente del SNEM y que fue organizado para el control de *A.aegypti* en Santa Cruz.

Ninguna de las instituciones anteriormente mencionadas cumple actividades de:

- Prestar atencion especializada en Medicina Tropical en la misma zona Tropical de colonizacion.

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- Realizar una vigilancia epidemiologica activa y continua de las enfermedades transmitidas por vectores en la zona tropical (Malaria, Fiebre amarilla, Dengue, Leishmaniasis, etc.).
- Realizar investigación bio-médica (principalmente en entomologia) para el control de las enfermedades mencionadas.
- Impartir enseñanza en servicio en la Patologia tropical a alumnos de Medicina en la misma zona tropical.

III. JUSTIFICACION

Desde hacen más de 10 años se han incrementado actividades de diversa naturaleza entre la población humana del tropico y sub-tropico de cochabamba, lo que hace que esta zona constituya un polo de desarrollo economico y social de mucha importancia. La afluencia de gente oriunda de todos los puntos del pais principalmente de los Valles y del Altiplano a la zona Tropical hace que en su contacto con la naturaleza se convierta en población a riesgo de todas las enfermedades tropicales endemicas con las consiguiente explosión de verdaderos "Brotes Epidémicos" de mucha importancia.

Por lo anteriormente expuesto, se ve que en el momento actual urge la necesidad de mejorar el sistema de atención médica en general y al mismo tiempo de organizar el Centro Universitario de Medicina Tropical, la misma que entre sus principales actividades cumpliria aquellas que otras instituciones del país no lo hacen, de esta manera no realizaria labor de competencia sino más bien complementaria las actividades de aquellas. Consideramos que las actividades que el Centro Universitario cumpliria son de vital importancia para mejorar la atencion medica en el tropico y contribuiria a solucionar varios de los problemas de salud en la región.

Esta institución dependiente de la Facultad de Medicina de la UMSS, podrá realizar sus actividades específicas en coordinacion con la Unidad Sanitaria de Cochabamba, a través de Comite Regional de Integracion Docente Asistencial y con otras instituciones similares del país como CENETROP, IBBA, etc.

IV. OBJETIVOS

General:

Reducir la morbilidad y morbimortalidad por Enfermedades Tropicales en el Trópico de cochabamba.

Especificos:

- Prestar atencion medica (diagnostico y tratamiento) especializada en Enfermedades Tropicales en la misma zona tropical.
- Realizar actividades de Vigilancia epidemiológica activa y continua de las Enfermedades Tropicales prioritaria.
- Impartir Enseñanza y Entrenamiento en servicio de Enfermedades Tropicales a alumnos de las carreras de Medicina, Bioquimica y Biologia de la UMSS, de pre y post-grado.
- Realizar investigación básica de los diferentes eslabones de la cadena epidemiologica tendientes al control de las principales Enfermedades Tropicales.
- Coordinación e información de los datos obtenidos al Ministerio de Previsión Social y Salud Pública, a través de la Unidad Sanitaria de Cochabamba.

IV. LIMITES

Espacio: Inicialmente en al área tropical y subtropical de Cochabamba, posteriormente a petición de las autoridades de salud, se abarcará al resto de la zona tropical del pais en campos especificos.

Tiempo: A iniciar en Enero de 1990, por tiempo indefinido.

Población: Humana, vectores y Reservorios de Enfermedades Tropicales.

VI. ORGANIZACION

El Centro Universitario de Enfermedades Tropicales (CUET) es una institución dependiente de la DIEMED (Direccion de Investigación y Extensión en Medicina).

Estará encargada exclusivamente de la atencion especializada, la vigilancia epidemiológica, la investigacion para el control , la enseñanza en Enfermedades Tropicales.

Sus actividades estarán íntimamente relacionadas con las similares del Depto. de Epidemiología de la Unidad Sanitaria de Cochabamba (Organigrama 1

Contará con reparticiones situadas en Cochabamba (Facultad de Medicina) en el Trópico (Centrales de Villa Tunari e Ivirgarzama) (Organigrama 2)

En Cochabamba contará con:

- Laboratorios de investigación (Protozoología, Helmintología, Entomología e Inmunología).
- Un laboratorio de diagnóstico general.
- Un servicio de atención médica en Medicina tropical.
- Servicios de utilización comunes (Preparación de medios de cultivo, Electroforesis, Inmunofluorescencia, Criohistología, Esterilización, Bioterio y Almacén).

En la zona Tropical contará (Villa Tunari e Ivirgarzama):

- Un servicio de atención médica especializada en Medicina Tropical.
- Un laboratorio de diagnóstico general y especializado en Enfermedades Tropicales y de Investigación.
- Unidades móviles de Vigilancia e Investigación para las Enfermedades Tropicales prevalentes en la región.

VII. PERSONAL

Dirección: El CUEI estará dirigido por un Director Científico (no administrativo) con base en Cochabamba.

Servicio Médico: Contará con un Médico Jefe, una Auxiliar de enfermería, 2 auxiliares de secretaría.

Laboratorio de Diagnóstico: Contará con un Bioquímico Jefe, un técnico y un auxiliar de laboratorio.

Laboratorios de Investigación: Cada uno de ellos contará inicialmente con un técnico y un auxiliar mientras se forme el personal responsable (Médicos, Bioquímicos o Biólogos).

Administración: A cargo de un administrador de carrera.

Servicios de Apoyo: Un auxiliar de Ropero, una auxiliar de esterilización y una encargada de limpieza, etc.

Atención Medica, Vigilancia e Investigación de la zona tropical: a cargo de un Médico Jefe, un Médico Asistente, una enfermera graduada, una auxiliar de enfermería y dos auxiliares de investigación.

Laboratorio: A cargo de un Bioquímico, un(1) técnico(1) y un(1) auxiliar(es) de laboratorio.

Servicios de Apoyo: Un(1) chofer(es), una auxiliar de servicios generales.

VIII. REQUERIMIENTOS (según presupuesto anexo)

Edificaciones: - De la Facultad de Medicina (Iroquis 2)

- De la zona tropical: anexadas a los Hospitales de Villa Tunari e Ivirgarzama.

Movilidades: - Una con sede en Cochabamba.

- Una con sede en el trópico.

Mobiliario: A implementar de acuerdo al crecimiento progresivo.

Equipamiento: A implementar también de acuerdo al crecimiento progresivo, mediante los proyectos de investigación a obtener de organismos internacionales (OMS, OMS, IDRC, AGCD, CEE, etc.).

Formación de personal: El Centro requerirá para sus trabajos especializados de un personal idóneo, con este objeto se conseguirán becas de formación en Instituciones internacionales para los profesionales seleccionados de acuerdo a estatutos vigentes en la UMSS.

IX. FINANCIAMIENTO:

Los salarios de personal estarán a cargo de la UMSS. Sin embargo, para asegurar su dedicación exclusiva se conseguirá financiamiento de los organismos concesores de "Grants" de investigación.

El financiamiento para las construcciones estará a cargo de la UMSS, Ministerio de Previsión Social y Salud Pública, organismos concesores de Grants de investigación.

El funcionamiento deberá estar asegurado por los Grants de investigación internacionales para proyectos específicos.

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PRESUPUESTO (US$)

SERVICIOS PERSONALES	Aporte de la UMSS			Por Financiar		
	1er Ano	2do Ano	3er Ano	1er Ano	2do Ano	3er Ano
4 Medicos investigadores	10.400	15.600	20.800	5.200	7.800	10.400
2 Bioquimicos	5.200	5.200	10.400	2.600	2.600	5.200
2 Biologos	10.400	10.400	10.400	5.200	5.200	5.200
8 Tecnicos	6.240	12.480	25.900	3.120	6.240	12.480
5 Auxiliares de laboratorio	5.200	10.400	13.000	2.600	5.200	6.500
3 Enfermeras	3.120	6.240	9.300	1.560	3.120	4.680
3 Auxiliares de Enfermeria	2.600	5.200	7.800	1.300	2.600	3.900
3 [illegible]	2.600	5.200	7.800	1.300	2.600	3.900
1 Administrador	5.200	5.200	5.200	2.600	2.600	2.600
3 Choferes	7.800	7.800	7.800	3.600	3.900	3.900
	58.760	83.720	118.520	29.380	41.860	59.260
2. Formacion de Personal						
1 Becario por PHD -Europa						
Pasajes	-	-	-	3.000	-	-
Beca	-	-	-	18.000	-	-
2 Becarios PHD -Europa						
Pasajes	-	-	-	3.000	-	3.000
becas	-	-	-	12.000	12.000	12.000
5 Becarios MSG -Europa						
Pasajes	-	-	-	7.500		
Becas	-	-	-	30.000	30.000	30.000
Subtotal	-	-	-	73.500	42.000	52.500

	Aporte de la UMSS			P o r Financiar		
	1er. ano	2do ano	3er. ano	1er. ano	2do. ano	3er. ano
3. Asesoria						
3 Expertos: 1 cada ano						
Pasajes:				3.000	3.000	3.000
Estadia				1.000	1.000	1.000
Sub Total:				4.000	4.000	4.000
4. Equipo Mayor						
4.1 Para Villa Tunari e Ivirgarzama						
Servicio de atencion medica	10.000			30.000	20.000	15.000
Laboratorio de Diagnostico e Investigacion	5.000			15.000	10.000	10.000
Unidades de vigilancia e Investigacion				15.000	15.000	15.000
4.2. Para Cochabamba:						
Laboratorio Protozoologia	10.000			20.000	20.000	20.000
Laboratorio Helmintologia	5.000			10.000	10.000	10.000
Laboratorio Entomologia	12.000			28.000	20.000	20.000
Laboratorio Inmunologia	5.000			20.000	20.000	20.000
Laboratorio Diagnostico general	5.000			20.000	20.000	20.000
Servicio de Atencion medica	5.000			15.000	10.000	5.000
Servicios comunes y otros				50.000	50.000	50.000
Sub total:	52.000			213.000	185.000	175.000
5. Material y Reactivos:						
Laboratorios-Cochabamba	2.000	2.000	2.000	8.000	5.000	3.000
Laboratorios-Tropico	1.000	1.000	1.000	5.000	3.000	2.000
Sub-Total:	3.000	3.000	3.000	13.000	8.000	5.000

	Aporte de la UMSS			Por Financiar		
	1er. ano	2do. ano	3er. ano	1er. ano	2do. ano	3er. ano
4. Bibliografia:						
Libros				3.000	3.000	3.000
Revistas (Inscripciones)				3.000	3.000	3.000
Sub total:				6.000	6.000	6.000
7. Funcionamiento						
Administracion	2.000	2.000	2.000	2.000	2.000	2.000
Laboratorio, Atencion Medica, etc.	2.000	2.000	2.000	2.000	2.000	2.000
Sub total:	4.000	4.000	4.000	4.000	4.000	4.000
8. Edificaciones						
Para Cochabamba	25.000			25.000	25.000	25.000
Para Ivirgarzama				30.000	10.000	10.000
Para Villa Tunari				30.000	10.000	10.000
Sub Total:	25.000			85.000	45.000	45.000
9. Movilidades						
Para Cochabamba				25.000		
Para Ivirgarzama				25.000	10.000	
Para Villa Tunari					25.000	10.000
Sub Total:				50.000	35.000	10.000
Total General:	142.760	99.720	125.520	477.880	370.860	360.760

RESUMEN PRESUPUESTARIO	Aporte de la U M S S			Por Financiar		
	1er. ano	2do. ano	3er. ano	1er. ano	2do. ano	3er. ano
1. Servicios Personales	58.760	83.720	118.520	29.380	41.860	59.260
2. Formacion de Personal				73.500	42.000	52.500
3. Asesoria				4.000	4.000	4.000
4. Equipo Mayor	52.000			213.000	185.000	175.000
5. Material y Reactivos	3.000	3.0[illegible]	3.000	13.000	8.000	5.000
6. Bibliografia				6.000	6.000	6.000
7. Funcionamiento	4.000	4.000	4.000	4.000	4.000	4.000
8. Edificaciones	25.000			85.000	45.000	45.000
9. Movilidades				50.000	35.000	10.000
Total General:	142.760	90.720	125.520	477.880	370.860	360.760

Total UMSS (3 anos) = 359.000 (29,68%)

Total a financiar (3 anos) =1'209.500 (70.32%)

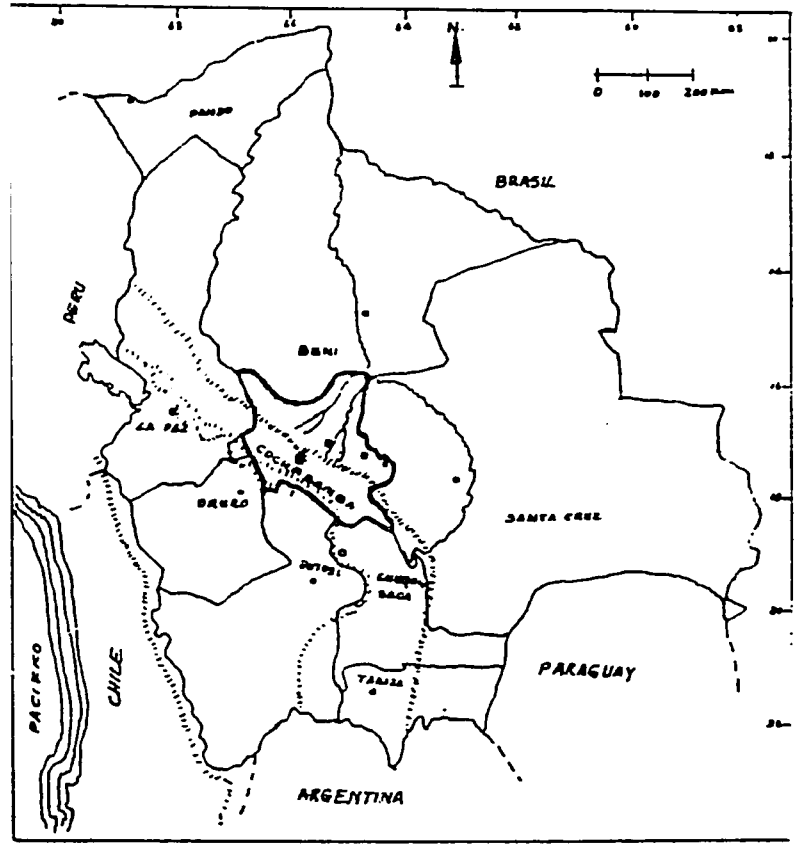
Total presupuesto (3 anos) =1'568.500

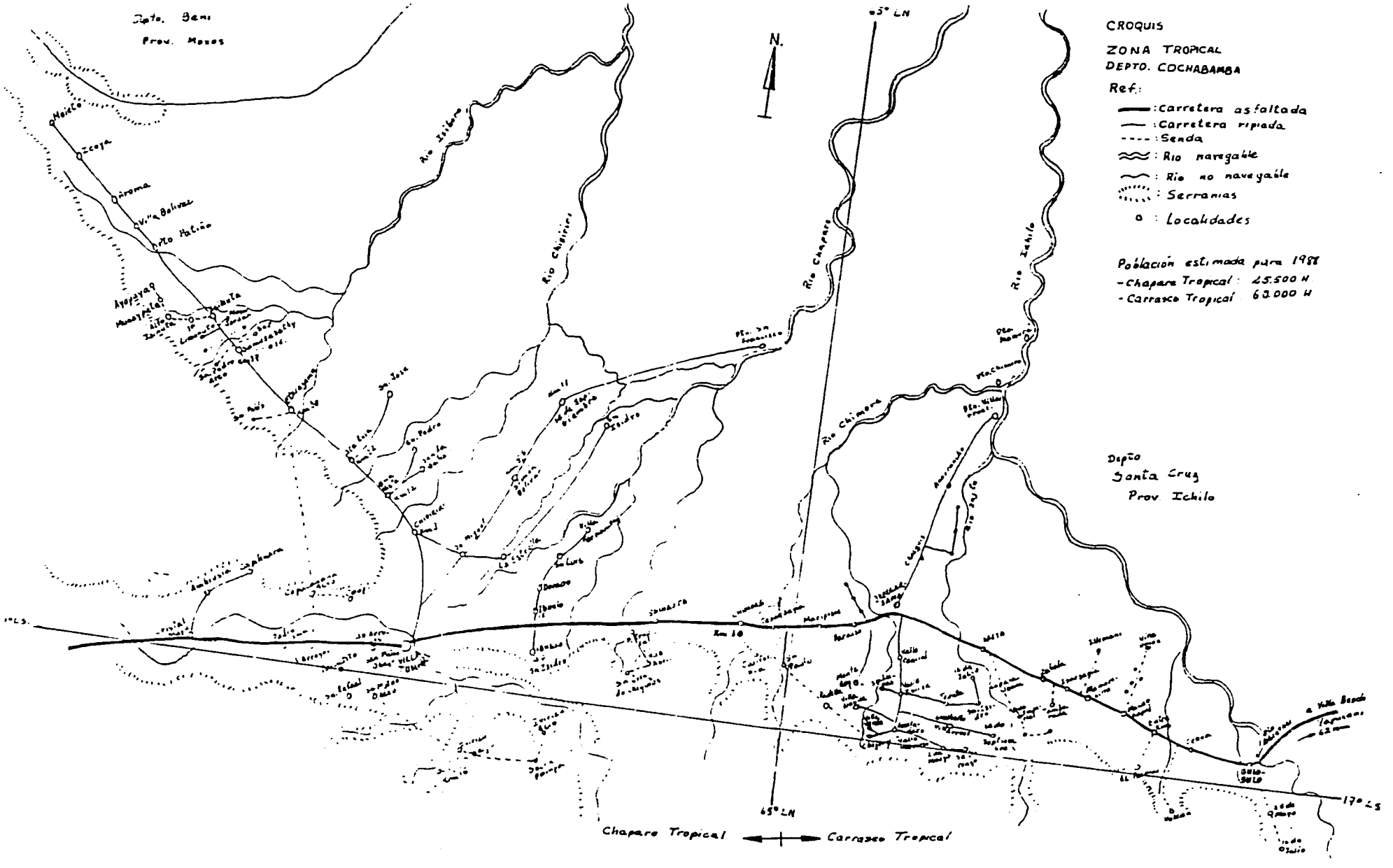
MAPA DE COCHABAMBA

67°
66°
65°
16°
17°
18°

LA PAZ
BENI
SANTA CRUZ
ORURO
POTOSI
CHUQUISACA

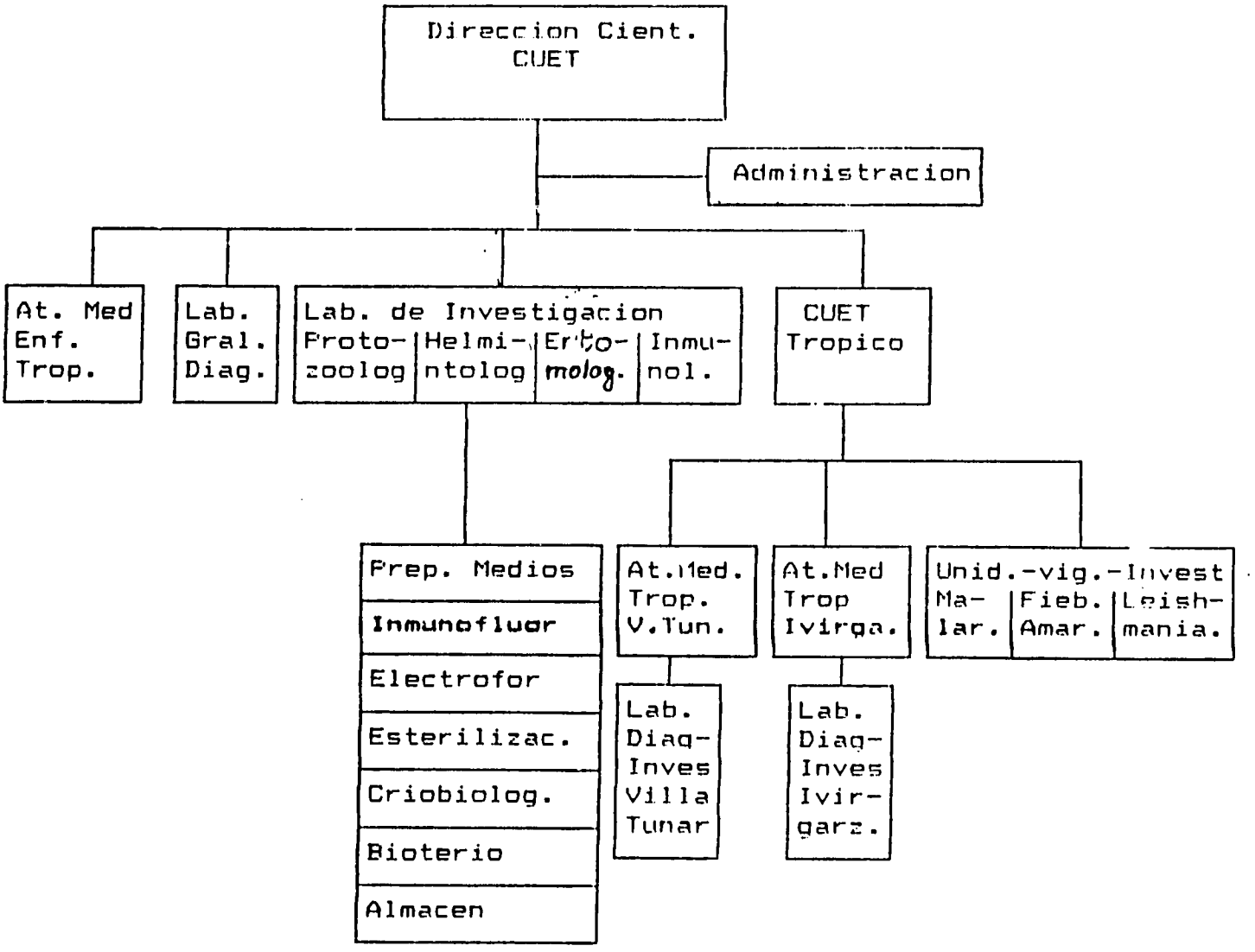
Chapare
Carrasco
Villa Tunari
Ivirgarzama
Bulo-Bulo
COCHABAMBA



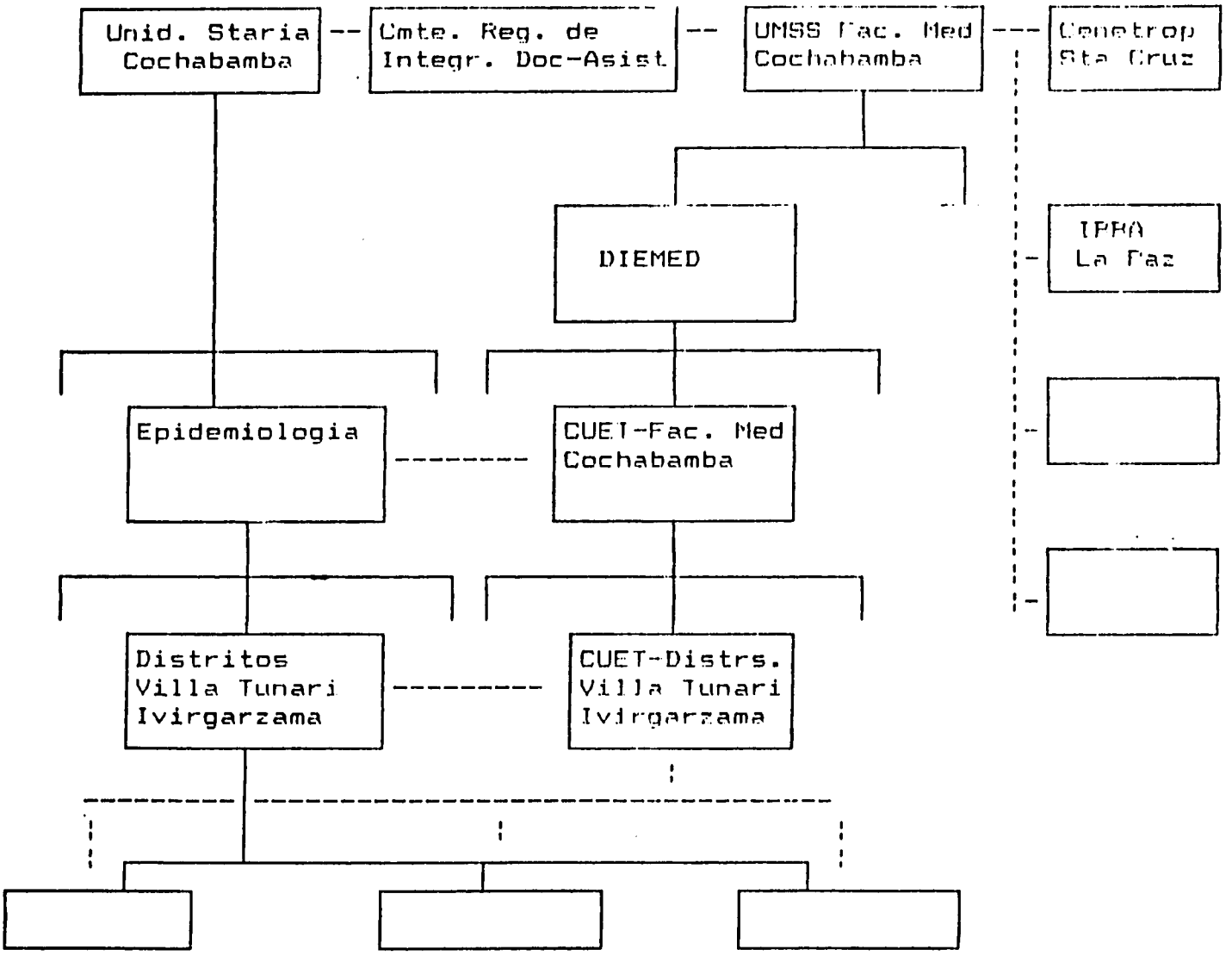

CROQUIS
ZONA TROPICAL
DEPTO. COCHABAMBA
Ref.:
: Carretera asfaltada
: Carretera ripiada
: Senda
: Rio navegable
: Rio no navegable
: Serranias
: Localidades
Población estimada para 1988
- Chapare Tropical : 45.500 H
- Carrasco Tropical : 63.000 H
Depto Santa Cruz
Prov. Ichilo
Depto. Beni
Prov. Moxos
N.
65° LN
17° LS
Rio Ichilo
Rio Chapare
Rio Chimore
Rio Chipiriri
Rio Isiboro
Chapare Tropical
Carrasco Tropical

Organigrama:

Centro Universitario de Enfermedades Tropicales



Organigrama: **Coordinacion entre el Centro Universitario de Enfermedades Tropicales y la Unidad Sanitaria de Cochabamba.**



_____ = Linea de Mando

------ = Coordinacion

Annex G

TDR Protocol:

Protocolo para el Ensayo de Nuevas Estragias de Control de Vectores de la Enfermedad de Chagas

WORLD HEALTH ORGANIZATION

ORGANISATION MONDIALE DE LA SANTÉ

TDR/CHA/U. 3/89.3

ESPAÑOL SOLAMENTE

PNUD/BANCO MUNDIAL/OMS/PROGRAMA ESPECIAL DE LA OMS
DE INVESTIGACIONES Y ENSEÑANZAS SOBRE
ENFERMEDADES TROPICALES

Montevideo, Uruguay
23-26 de octubre de 1989

PROTOCOLO ESTANDAR PARA EL ENSAYO DE NUEVAS ESTRATEGIAS DE CONTROL DE VECTORES DE LA ENFERMEDAD DE CHAGAS

CONTENIDO

		Página
I)	INTRODUCCION	1
II)	EPIDEMIOLOGIA DE LA ENFERMEDAD DE CHAGAS Y ESTRATEGIAS DE CONTROL	2
III)	PROTOCOLO PARA EL ENSAYO DE NUEVAS ESTRATEGIAS DE CONTROL	3
	A) ESTUDIO ENTOMOLOGICO DE TRANSMISION	4
	B) ESTUDIO DE ACEPTABILIDAD SOCIAL	8
	C) EVALUACION ECONOMICA	11
	LISTA DE FORMULARIOS	19

I) INTRODUCCION

La sesión inaugural se inició con la presentación del Dr. A. Moncayo, Secretario del Comité Directivo para Enfermedad de Chagas del Programa Especial de Investigaciones y Enseñanzas sobre Enfermedades Tropicales PNUD/Banco Mundial/OMS. Se señaló la importancia de la reunión para producir un protocolo para el ensayo de nuevas estrategias de control desarrolladas por investigadores de la Región para la eliminación de triatomíneos domiciliarios y se resaltó que el trabajo que se proponía era un esfuerzo común multipaises de los Programas Nacionales de Control, lo que demuestra la importancia que se otorga a la enfermedad de Chagas en la Región.

This report contains the collective views of an International group of experts convened by the UNDP/WORLD BANK/WHO SPECIAL PROGRAMME FOR RESEARCH AND TRAINING IN TROPICAL DISEASES (TDR). It does not necessarily reflect the views of TDR/WHO. In the interests of rapid communication it has been submitted to only minimal editorial revision. Moreover, any geographical designations used in the report do not imply the expression of any opinion whatsoever on the part of TDR or WHO concerning the legal status of any country, territory, city or area or of its authorities concerning the delimitation of its frontiers or boundaries.

Ce rapport exprime les vues collectives d'un groupe international d'experts réuni par le PROGRAMME SPECIAL PNUD/BANQUE MONDIALE/OMS DE RECHERCHE ET DE FORMATION CONCERNANT LES MALADIES TROPICALES (TDR). Il ne représente pas necessairement les vues du TDR/OMS et, en vue d'une diffusion accélérée, il n'a pas été l'objet d'une mise en forme particulierement soignée. En outre, les noms géographiques utilisés dans le présent rapport n'impliquent, de la part du TDR ou de l'OMS, aucune prise de position quant au statut juridique de tel ou tel pays, territoire, ville ou zone, ou de ses autorités, ni quant au tracé de ses frontières

5. Paraguay

La prevalencia de infección por T. cruzi en la población general es del 20% y la de infestación de viviendas por el Triatoma infestans es del 14%.

Recientemente se inició el control serológico en donantes de sangre de la ciudad de Asunción.

6. Uruguay

El principal vector es el T. infestans. Sin embargo, se presenta con características de colonización diferente en el área noreste, donde es intradomiciliario, y en el área sureste, donde es peridomiciliario.

En el área endémica, donde viven alrededor de 965 000 personas, se considera que existen 36 000 individuos infectados. La serología para T. cruzi es positiva en el 1% de los donantes de la capital, y en más del 10% de los donantes del área de alta endemicidad.

ESTRATEGIAS

Se relató la experiencia existente con la utilización del pote fumígeno, señalándose que en experiencias piloto tres aplicaciones sucesivas mensuales del pote produjeron una disminución significativa en número de triatomíneos intradomiciliarios. Además se describió la utilidad del pote para las acciones de control que se llevan a cabo por medio de la APS. También se presentó el efecto beneficioso del insecticida malatión disuelto en un soporte de látex cuando es aplicado en el domicilio y en el peridomicilio.

Se destacó la utilidad de esta "pintura" ya que el insecticida se libera en forma lenta, se adhiere perfectamente a cualquier superficie, no es lavado por la lluvia y se aplica como si fuese el insecticida usado tradicionalmente por el Programa de Control.

En relación a las reacciones que la población y los ejecutores del programa podrían tener por la ejecución de nuevas medidas de intervención, se consideró que las mismas podrían ser tanto positivas como negativas pero dependientes de las condiciones sociales y psicosociales de la población. Se describieron las variables sociales, su interrelación, los instrumentos de recolección de datos y la metodología de análisis utilizables en un protocolo destinado a determinar la aceptabilidad de nuevas estrategias de control.

Se consideraron los aspectos económicos del ensayo de estrategias de control haciéndose especial énfasis en la metodología para llevar a cabo los análisis de costo-beneficio, y costo-eficiencia, y las características que tendría que tener un protocolo destinado a determinar esos parámetros en relación a las nuevas estrategias.

Después de las presentaciones y teniendo en cuenta la experiencia previa, se concluyó que ya era oportuno llevar a cabo un estudio sobre las dos estrategias de control vectorial desarrolladas en la Región de acuerdo con el siguiente protocolo.

III) PROTOCOLO PARA EL ENSAYO DE NUEVAS ESTRATEGIAS DE CONTROL

OBJETIVOS

Objetivo general:

Ensayar intervenciones de control de la enfermedad de Chagas con nuevas herramientas desarrolladas con apoyo del TDR, como una contribución al desarrollo de Programas de Control.

1)	DIF.( )	0,10	606	control
			303	cada grupo experimental
			N =	1515
2)	DIF.( )	0,15	300	control
			150	cada grupo experimental
			N =	750
3)	DIF.( )	0,20	184	control
			92	cada grupo experimental
			N =	460

La selección aleatoria de las localidades donde se realizará el estudio se hará dentro del total de localidades infestadas, comprendidas en los municipios de las dos áreas de estudio.

Las viviendas serán a su vez seleccionadas aleatoriamente para cada una de las intervenciones, que pueden ser estratificadas por agrupamientos naturales y para las actividades de seguimiento entomológico (50% de las viviendas método hora/hombre y 50% con sensor MARIA).

TAMAÑO DE LA MUESTRA

Tres grupos de viviendas (unidad estadística) serán conformados en localidades seleccionadas al azar mediante números aleatorios hasta completar 150 viviendas para cada grupo de estudio experimental y 300 para el grupo control.

	Número de viviendas	
Grupo experimental 1	150	
Grupo experimental 2	150	
Grupo experimental 3	150	
Grupo control	300	(Administrativamente se considera como dos grupos de 150 casos)
TOTAL	750	

La experiencia indica que la proporcion de casas que en cada país se pueden considerar como de construcción abierta es aproximadamente del 40% en Argentina, Chile y Honduras, del 65% en Bolivia, del 100% en Paraguay y del 40% en Uruguay.

II) Metodologia

1. Se realizará el mapeamiento y un censo de las localidades seleccionadas.

2. La información basal que se recolectara será la siguiente:

a) Indices de infestacion por triatomíneos en el 100% de las viviendas (media hora/hombre/cuarto de cada localidad dentro del estudio).

- Vivienda positiva: será aquella en que se encuentren triatomíneos adultos y/o ninfas a través de la búsqueda por media hora/hombre/habitación o se encuentren rastros.

- Vivienda negativa: aquella en que no se encuentren adultos, ninfas o rastros.

b) Indices de prevalencia serológica serán determinados en el 100% de los habitantes de las viviendas del estudio, mediante detección de anticuerpos anti-T. cruzi en muestras de sangre tomadas y

3. Durante las visitas para la evaluación entomológica se registrará cualquier cambio ocurrido en la vivienda por iniciativa de sus habitantes (ampliaciones, cambio de techo, etc.), así como en el peridomicilio.

4. Las viviendas en que se detecte infestación después de la aplicación de las intervenciones serán tratadas con rociamiento tradicional intra y peridomiciliario y quedarán eliminadas del estudio.

IV) Procesamiento y análisis de datos

Debido a la gran cantidad de información que será generada en el ensayo, se deberá:

1. Todas las informaciones contenidas en los distintos formularios serán codificadas para ser procesadas por computadora. Esto implica el desarrollo de manuales de codificación para ser utilizados en las diferentes áreas.

2. Serán implementados bancos de datos de las diversas áreas, utilizándose programas comerciales únicos.

3. Será implementado un banco de datos general bajo supervisión del TDR. La transferencia de informaciones será a través de disquetes.

4. Los diferentes proyectos serán analizados localmente; para eso sera necesario desarrollar competencia local.

5. De manera general, el método de analisis que se adoptará será el de comparar "Curvas de Sobrevida" obtenidas con los diferentes métodos y en diferentes áreas.

CRONOGRAMA PROPUESTO

MESES	ACTIVIDADES
ENERO/90	- Recepción del Protocolo en el TDR/Ginebra
	- Procesamiento formularios
	- Fase preparativa de planeación
	- Ajuste del Presupuesto Nacional de los Programas
MAYO/90	Estudio de base
	- Encuesta serológica, mapas y censo del área
	- Relevamiento de índices entomológicos
	- Asignación de las viviendas a los grupos experimentales y controles
	- Capacitación y visita de consultores
	- Prueba de formularios
SEPTIEMBRE/90	- Inicio de las intervenciones

Sobre la aceptabilidad:

1. Aceptabilidad del producto: olor, color, molestia causada en la cotidianidad, irritación, disposición a usarlo por su cuenta propia, beneficios percibidos.

2. Aceptabilidad del procedimiento: molestias causadas por su aplicación, dificultades para el traslado, aplicación, por parte de los aplicadores, temor de pérdida de trabajo/importancia por parte de los aplicadores.

Sobre condiciones sociales:

3. Ocupación - ingreso

4. Propiedad de la tierra donde se trabaja

5. Propiedad mercadeabilidad de la vivienda

6. Conocimientos e importancia asignada a la enfermedad

7. Arraigo

8. Educación

9. Sexo y edad

10. Composición familiar

11. Conocimiento sobre la construcción/mejoramiento vivienda

Sobre la vivienda:

12. Condiciones propicias de la vivienda. paredes, techo, piso, peridomicilio.

7. Metodología: actividades y tecnicas

1) Sensibilización

Se considera que la primera etapa de presentacion del experimento a la población, así como los mensajes que los operadores deban transmitir cuando se realizan las actividades de aplicacion, deben ser controladas y estandarizadas. Es decir debe existir un procedimiento común de aplicación y de mensaje que debe establecerse y transmitirse a los operadores durante su entrenamiento, con normas claras que no deben dar más ni distintas informaciones de las consideradas en la presentación del programa y distribuidas por los investigadores.

2) Recolección de información

Se considera que existirán tres tipos de actividades de recolección de información:

a) las encuestas: que tendrán dos versiones, una será aplicada a la población, al jefe de familia o su esposa, o preferiblemente a ambos. Otra, que será aplicada a los operadores de terreno encargados de aplicar las herramientas. Las dos encuestas serán aplicadas transcurridos tres meses de haberse iniciado los tratamientos y siguiendo el mismo orden temporal de su aplicación, a fin de garantizar similaridad en la distancia temporal entre su aplicación y la encuesta.

C) EVALUACION ECONOMICA

I. METODOLOGIA PROPUESTA

La metodologia propuesta se basa en el análisis COSTO-EFECTIVIDAD que consiste en conocer cuánto cuesta obtener cada unidad del objetivo buscado, para cada una de las herramientas.

Se deben seguir los siguientes pasos:

1. Cuantificación de los costos de cada herramienta

2. Cuantificación de la efectividad de cada herramienta

3. Obtención del cociente COSTO-EFECTIVIDAD para cada herramienta.

II. CUANTIFICACION DE LOS COSTOS

Se seguirán los siguientes pasos:

1. Se registrarán los costos trimestrales de cada una de las herramientas de acuerdo a las planillas de los cuadros 1, 2, 3, 4 y 5.

2. Se actualizan los costos para el momento en que comenzaron las intervenciones. Dicha actualización será trimestral de acuerdo a la formula expresada en los cuadros 6 y 1.

3. Los costos actualizados deberán presentarse en forma discriminada de acuerdo a los cuadros 7 (costos absolutos) y 8 (estructura relativa).

Para la cuantificación de los costos deberán observarse, absolutamente, los siguientes parámetros:

1. La moneda utilizada para los cálculos será el dólar americano.

2. La tasa de descuento utilizada deberá reflejar el costo social del capital para cada país. Podrá ser distinta entre países pero deberá ser la idéntica para todas las herramientas aplicadas dentro de un mismo país.

3. Para los costos de capital se utilizarán los gastos trimestrales de depreciación calculados de acuerdo al costo de reposición al comienzo de la aplicación.

4. Si existieran trabajadores voluntarios, se les asignará un costo igual a otro trabajador remunerado que realice la misma tarea.

5. Para todos los recursos utilizados (recurrentes y de capital), se deberá constatar su dedicación a la aplicación de las herramientas y asignárseles una ponderación consecuente.

6. Sólo se deberá imputar a la aplicacion de cada herramienta los costos en los cuales se incurra para tratar las viviendas mientras las mismas no se reinfesten.

7. El costo de aquellas viviendas que se reinfesten y se les deba aplicar, por razones éticas, el rociado tradicional, no será imputado a ninguna de las herramientas, aun cuando se trate de las viviendas del grupo de control.

CUADRO N° 1

COSTO TRIMESTRAL DE PERSONAL POR HERRAMIENTA H_i

(a) Cargos	(b) (%) Asignación de tiempo	(c) (US$) Remuneración trimestral	(d) Prorrateo trimestral de otros ingresos	(e) Prorrateo trimestral de cargas legales	(f) Total = a x b (c + d + e)

CUADRO N° 2

COSTO TRIMESTRAL DE MATERIALES Y SUMINISTROS

Descripción	Unidades	Costo unitario	Total

CUADRO N° 5

COSTO DE CAPITAL DE HERRAMIENTA H_i

(a) Categoría	(b) Costo de reposicion	(c) Vida útil	(d) Gastos trimestrales de depreciación	(e) Asignacion al proyecto	(f) Total (d x e)
Vehículos					
Equipos					
Edificios					
Otros activos					

CUADRO N° 6

RESUMEN DE COSTOS DEL TRIMESTRE "K" PARA LA HERRAMIENTA H_i

Costos recurrentes	Monto trimestral = a	Factor de actualización $b = 1/(1 + d)^k$	Monto trimestral actualizado c = a x b
· Personal · Materiales y suministros · Viajes y transportes · Otros costos			
Costos de capital			
Gastos trimestrales de depreciación por asignación al proyecto: · vehículos · equipos · edificios · otros activos		No se actualizan pues se calculan en base al costo de reposición al comienzo de la aplicación	c = a
TOTAL			

CUADRO Nº 9

MEDICION DE LA EFECTIVIDAD

Trimestre	(a) Nº de casas que conforman la muestra del grupo	(b) Nº de casas reinfestadas	(c) Factor de corrección	(d) Nº corregido de casas reinfestadas b x c	(e) Nº corregido de casas sobrevivientes a - d
1			1		
2			33/36		
3			30/36		
4			27/36		
5			24/36		
6			21/36		
7			18/36		
8			15/36		
9			12/36		
10			9/36		
11			6/36		
12			3/36		
TOTAL					

CUADRO Nº 10

COEFICIENTE COSTO-EFECTIVIDAD POR HERRAMIENTAS

Herramienta / Costo-efectividad	H_1	H_2	H_3	H_4
Costo triannual actualizado A				
Nº corregido de casas sobrevivientes B				
Coeficiente de costo-efectividad C = A/B				

LISTA DE FORMULARIOS

1) Tipificación de domicilio y peridomicilio
2) Examen de triatomíneos (especie; estadio; infección)
3) Evaluación entomológica hora/hombre
4) Planilla de evaluación del sensor
5) Ficha familiar
6) Tarjeta de identificación de la vivienda
7) Ficha de aplicación de intervenciones
8) Resultados de serología
9) Formulario de aceptabilidad social.

Formulario 1, p. 2

Se encontraron triatomíneos SI _____ NO _____

SI: __ aislados _____ colonias _____

Tiempo de vivir en la vivienda _____

PERIDOMICILIO

Tamaño: medido desde vivienda hasta construcción más lejana (radio)

Accidentes: palmeras _____ nidos y/o madrigueras _____

cerco de piedras _____ pedregales _____

Animales: domésticos _____ sinantrópicos _____

N° de estructuras: gallinero _____ corral _____

conejera _____ otros _____ (especificar)

techados _____ no techados _____

material _____

Material pared: _____

Material piso: _____

Encuestados: _____

Fecha: _____

FORMULARIO 3

EVALUACION ENTOMOLOGICA HORA-HOMBRE

Jefe grupo ..... Provincia ..... Dpto. ..... Fecha último tratamiento .....
Integrantes ..... Municipio ..... Insecticida utilizado .....
..... Hora salida ..... Hora regreso ..... Dosis .....
.....

Localidad ..... Fecha ..... Técnica utilizada .....

Nº CASA	APELLIDO Y NOMBRE	DOMICILIO (D)										PERIDOMICILIO (PD)										SUPERFICIE APROX. M^2		TIPO VIVIENDA
		DORMITORIO					COCINA*					GALLINERO					CORRAL							
		INF.[1]		SILV.[2]		N	INF.		SILV.		N	INF.		SILV.		N	INF.		SILV.		N	D	PD	
		N	A	N	A	%	N	A	N	A	%	N	A	N	A	%	N	A	N	A	%			
	TOTALES																							

REFERENCIAS: (N) NINFA (A) ADULTO (T) TOTAL TRIATOMINEOS

* Cuando está fuera de la vivienda considerarla dentro de peridomicilio

TIPO VIVIENDA

(R) RANCHO
(I) INTERMEDIO CASA RANCHO (techo o paredes de rancho)
(M) BUENA CONSTRUCCION

[1] T. INFESTANS (MARCAR EN ROJO) [2] SILVESTRES (MARCAR EN AZUL)

Instrucciones para el uso del sensor "MARIA"

Cantidad: 2 sensores por dormitorio independientemente del número de camas.

Ubicación Aproximadamente a 1,80 m del suelo, en la cabecera o pared adyacente de las camas (1 semana después del tratamiento insecticida).

Revisión: Retirarlo con cuidado y desarmarlo sobre una mesa, para evitar que se caigan los elementos sin ser vistos.

Si hubiera rastros, marcarlos con birome para no repetir la lectura en las próximas evaluaciones. Indicar en la planilla el número y tipo de elementos encontrados en todos los sensores presentes en las casas.

FORMULARIO 6

TARJETA DE IDENTIFICACION DE LA VIVIENDA

Departamento _____

Sec. Judicial N° _____

Segmento N° _____

Zona N° _____

Casa N° _____

Fecha	Hora	Tarea	Falla	Nombre y N° del Responsable

FORMULARIO 8

RESULTADOS DE SEROLOGIA

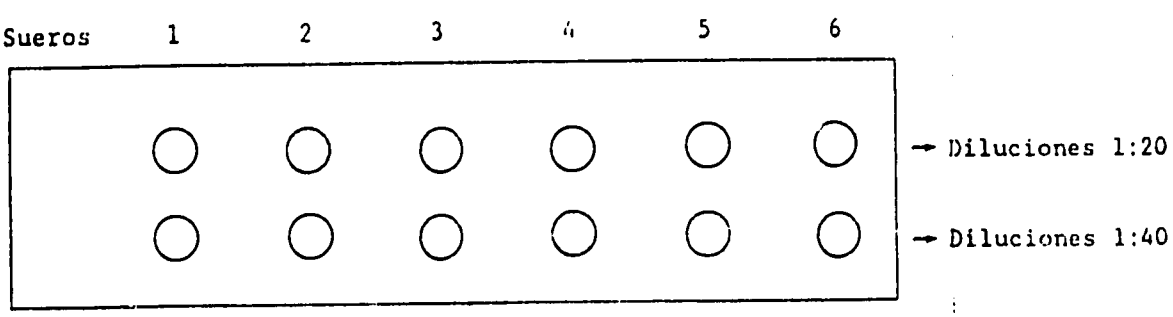
Fecha _____

HEMAGLUTINACION INDIRECTA:

	3	6	9	12
A:	_____	_____	_____	_____
B:	_____	_____	_____	_____
C:	_____	_____	_____	_____
D:	_____	_____	_____	_____
E:	_____	_____	_____	_____
F:	_____	_____	_____	_____
G:	_____	_____	_____	_____
H:	_____	_____	_____	_____

INMUNOFLUORESCENCIA INDIRECTA:

LAMINA:



Sueros
1: _____
2: _____
3: _____
4: _____
5: _____
6: _____

II - Preguntas para los rociadores

1) Diría que el transporte de los productos y equipamientos para tratar las casas y anexos, según el grupo en el que ha trabajado, fue:

Grupo pintura ..... complicado _____
..... sencillo _____
..... normal _____

Grupo convencional ..... complicado _____
..... sencillo _____
..... normal _____

Grupo pote adentro + convencional afuera ..... complicado _____
..... sencillo _____
..... normal _____

Grupo pintura adentro + convencional afuera ..... complicado _____
..... sencillo _____
..... normal _____

2) Considera usted que las maniobras realizadas para la aplicación del producto, según el grupo en el que ha trabajado, fueron:

Grupo pintura ..... complicado _____
..... sencillo _____
..... normal _____

Grupo convencional ..... complicado _____
..... sencillo _____
..... normal _____

Grupo pote adentro + convencional afuera ..... complicado _____
..... sencillo _____
..... normal _____

Grupo pintura adentro + convencional afuera ..... complicado _____
..... sencillo _____
..... normal _____

ANEXO

REUNION PARA DESARROLLO DE UN PROTOCOLO ESTANDAR PARA EL ENSAYO DE NUEVAS ESTRATEGIAS DE CONTROL DE VECTORES DE LA ENFERMEDAD DE CHAGAS

Montevideo, Uruguay, 23-26 de octubre de 1989

LISTA DE PARTICIPANTES

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