Case 12

# Controlling Chagas Disease in the Southern Cone of South America

**Geographic area:** Seven countries in South America's southern cone: Argentina, Bolivia, Brazil, Chile, Paraguay, Uruguay, and Peru

**Health condition:** In the early 1990s, Chagas disease was ranked as the most serious parasitic disease in Latin America. The disease was endemic in all seven countries of the southern cone, and wavering political commitment and reinfestation of the insect vectors across borders hampered efforts to control the disease.

**Global importance of the health condition today:** Today an estimated 11 million people in 15 Latin American countries are infected with Chagas disease. The disease also plagues northern South America, Central America, and Mexico, as well as the remaining pockets in the southern cone.

**Intervention or program:** The Southern Cone Initiative to Control/Eliminate Chagas was launched in 1991 under the leadership of the Pan American Health Organization. Spray teams operated by ministries of health have treated more than 2.5 million homes across the region with long-lasting pyrethroid insecticides. Houses in poor rural areas have been improved to eliminate the insect's hiding places, and blood is screened for Chagas disease.

**Cost and cost-effectiveness:** Financial resources for the regional program, provided by each of the seven countries, have totaled more than $400 million since 1991. The intervention is considered among the most cost-effective interventions in public health, at just $37 per disability adjusted life year saved in Brazil.

**Impact:** Incidence in the seven countries covered by the initiative fell by an average of 94 percent by 2000. Overall, the number of new cases on the continent fell from 700,000 in 1983 to fewer than 200,000 in 2000. Furthermore, the number of deaths each year from the disease was halved from 45,000 to 22,000. By 2001, disease transmission was halted in Uruguay, Chile, and large parts of Brazil and Paraguay.

If ever there were a good example of a problem calling for a regional solution and steady sustained leadership, Chagas disease is it. Chagas disease, or American trypanosomiasis, is a debilitating and deadly infection that afflicts rural communities throughout Latin America. The poorest people living in rural areas, particularly those with inadequate housing, are the most vulnerable. In the early 1990s, Chagas disease was ranked as the most serious parasitic disease in Latin America, with a socioeconomic impact greater than that of all the other parasitic infections combined.[1] An estimated 16 million to 18 million people in Latin America were infected with the disease a decade ago, with 50,000

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deaths each year.[2] An additional 120 million people—one quarter of the population of Latin America—were thought to be at risk of infection. Today, thanks to large regional efforts to control the disease, just over 11 million are infected, and incidence across the continent has fallen 70 percent.[3] However, unsteady commitment at the highest levels has jeopardized the achievements at various times, demonstrating how the very result of success—fewer people infected—can undermine long-term sustainability.

## "Kissing Bug" Disease

The disease is named after Carlos Chagas, the Brazilian doctor who first described it in 1909 and subsequently discovered its cause: a protozoan parasite, *Trypanosoma cruzi*. The parasites are harbored within the feces of "kissing bugs," several species of blood-feeding insects in the subfamily *Triatominae*. In many rural areas, these insects live within the walls of houses and emerge at night to suck human blood. The parasites enter the bloodstream when the insect bites are rubbed or scratched or when food is contaminated. The second most common route of infection is infected blood, a risk that is heightened when rural hardship forces people to migrate to cities. The disease also can be spread from an infected mother to her fetus.

Two phases mark the course of Chagas disease. First comes the acute phase, during which symptoms are relatively mild. A small sore that frequently develops around the bite is the first sign of infection. Within a few days, the parasite invades the lymph nodes, and fever, malaise, and swelling may develop. This first phase can be fatal, especially in young children. In most cases, however, infected individuals enter the second, chronic stage and show no symptoms for several years. During this period, the parasites spread throughout the major organs of the body, damaging the heart, intestines, and esophagus. Complications associated with the disease include congestive heart failure, abdominal pain and constipation, and swallowing difficulties that can lead to malnutrition.[4] In nearly one third of all cases, the damage to the heart and digestive system proves fatal.

The lost years of productive lives of Chagas disease victims, combined with the expense of treating patients, make it an extremely costly disease. The estimated economic loss due to premature deaths between 1979 and 1981 in Brazil alone topped $237 million, and $750 million would have been needed each year to treat the cardiac and digestive problems from Chagas disease in Brazil.[3]

Chagas is endemic in 15 countries in Latin America. These countries fall into two broad ecological zones. The first is the southern cone—Argentina, Brazil, Bolivia, Chile, Paraguay, Peru, and Uruguay—where the species of blood-sucking insects that spread the parasites lives entirely inside houses. The second zone embraces northern South America, Central America, and Mexico, where the insect vectors are harder to eradicate because reinfestations can occur from hardier species that can survive outside homes.

Unfortunately, no vaccine currently exists to prevent the disease, and treatment strategies remain poorly developed. Acute infections in newborns and young children and infections in the chronic phase can, during the first few years, respond to the drugs nifurtimox and benznidazole in at least half the cases. However, because these drugs are of little use in later chronic infections, have serious side effects, and are prohibitively expensive, their use is limited. Long-term symptomatic treatment of chronic disease requires specialized clinics, which are beyond the means of most patients. As a result, control efforts require the prevention of new infection—by eliminating the vector and screening the blood supply.

## Early Attempts to Tackle the Disease

Beginning with the pioneering insights of Carlos Chagas and his colleagues in Brazil, many generations of workers have searched for effective ways of destroying the insect vectors that live within homes. Early attempts entailed dousing the walls of houses with kerosene or scalding water and even scorching walls with military flamethrowers. More effective, but equally impractical on a large scale, were schemes to enclose houses in canvas tents and fill them with cyanide gas.[1] During the 1940s, the introduction of synthetic insecticides offered a more plausible solution. Although DDT was quickly found to be ineffective against the insects, two other organochlorine insecticides, dieldrin and lindane, did kill the insects. Spraying campaigns began in several countries in the 1950s and 1960s.

A major breakthrough occurred in the early 1980s when synthetic pyrethroid insecticides were developed. These new chemicals proved even more effective than the earlier insecticides—at lower doses and even in single applications. The new treatments were more cost-effective and significantly easier to use than earlier methods. They were more attractive to both sprayers and residents because they left neither unpleasant smells nor stains on the walls of infected homes.

Armed with this improved technology, Brazil's Ministry of Health initiated a national eradication campaign in 1983, which showed promising results. The campaign set out to eradicate the main vector, the kissing bugs, through nationwide spraying programs. Community vigilance schemes staffed by volunteers ensured that all infected houses were sprayed. Residents who spotted insects were encouraged to alert the local volunteer post known as Posto de Informacao sobre Triatomineos, or PIT. By 1986, almost three quarters of the infested localities had been mapped, sprayed, and placed under the scrutiny of local PIT volunteers.[1]

Brazil's early success with the program demonstrated the technical feasibility of vector control efforts. However, the program also exposed two challenges facing the fight against Chagas disease: border-crossing insects and wavering political commitment. Despite the diligent mapping and control efforts within its borders, Brazil's campaign faced disease transmission from neighboring countries. The insect vector can easily cross borders and is thought to have originated in Bolivia and spread across a large swath of the continent, hidden in people's belongings as they moved from one place to another. As such, Brazil's experience demonstrated that unilateral control efforts would be unable to defeat the disease. Furthermore, attention in 1986 was suddenly shifted away from Chagas disease to a new threat in Brazil: the return to coastal cities of the insect vector of yellow fever and dengue. Urban populations were suddenly at risk, generating widespread alarm in the media and political circles. As the focus shifted to urban concerns, the rural Chagas disease campaign was sidelined, and political commitment waned. As a result, the program's earlier achievements eroded.[1] The malaria control program in Brazil experienced similar challenges around the same time (see Box 12–1). For both Chagas and malaria, new strategies were needed.

## A United Front: The Southern Cone Initiative Is Launched

In 1991, a new control program, known as the Southern Cone Initiative to Control/Eliminate Chagas (INCOSUR) addressed these challenges and marshaled the commitment of the countries of the southern cone region where Chagas was an endemic threat. The initiative was a joint agreement among the governments of Argentina, Bolivia, Brazil, Chile, Paraguay, Uruguay, and later Peru, which set out to control Chagas disease through the elimination of the main insect vector. Led by the Pan American Health Organization (PAHO), the initiative was designed to bolster national resolve and prevent cross-border reinfestations.

Within the INCOSUR, each country finances and manages its own national program. However, regional cooperation has proved essential to the program's success and has been coordinated by PAHO. Each year, representatives from the collaborating nations share operational aims, methods, and achievements at a PAHO-sponsored annual meeting of the Intergovernmental Commission of the Southern Cone. A series of intercountry technical cooperation agreements has fostered the sharing of information among scientists throughout the region and among their respective government organizations.

Additional scientific support has been provided by a network of research groups in 22 countries and has had "a decisive influence on our understanding of the biology and evolution of domestic vectors of disease," says Chris Schofield, a leading Chagas disease researcher at the London School of Hygiene and Tropical Medicine.[7] WHO's Special Programme for Research and Training in Tropical Diseases has provided additional support.

## Successful Strategies in Practice

Elimination of the insect vector in infested homes was a vital first step, and the technical and operational procedures for achieving this goal are now demonstrably successful and cost-effective. The professional treatment of houses with long-lasting pyrethroid insecticides has eliminated or greatly reduced the insect vector population throughout the southern cone. Spray teams operated through the ministries of health treat each house in municipalities where the vector's presence has been

## Box 12–1

# Combating Malaria in Brazil

As more effective means of combating the Chagas vector were being deployed in Brazil in the late 1980s, the country was also facing a mounting death toll from malaria, another disease borne by an insect vector.

In Brazil, as elsewhere, the fight against malaria has been characterized both by periods of optimism and moments of defeat. By the late 1970s, most of Brazil was malaria free, thanks largely to the application of insecticides through in-house spraying. But the traditional control approach, which had succeeded elsewhere in the country, was failing in the Amazon basin, home to the largest tropical rain forest in the world. Thick vegetation, scattered and sometimes temporary human settlements—including migrating miners who slept in improvised tents that could not retain insecticide—impeded vector control and case-finding measures. In the Amazon, malaria prevalence and fatality rates were high and, at the time, growing fast. Between 1977 and 1988, the deaths from malaria per 100,000 population had more than quadrupled, and by the end of the period incidence had reached almost half a million cases.[5]

Recognizing the special problems of malaria in the region, the government of Brazil obtained financing and technical support from the World Bank for the Amazon Basin Malaria Control Project. The project, which was designed to last four years and eventually took seven, started operations in late 1989. It was intended to help the government deal with the malaria problem in the Amazon basin, prevent spread into uninfected areas, and increase the capacity of public health authorities involved in malaria control.

The program's technical strategy evolved as new challenges arose. Observing the results of early *Plasmodium falciparum* vaccine trials in Colombia and Ecuador, Renato Gusmao and other advisors from PAHO noticed that when health care personnel were dedicated to early detection and immediate treatment of every *P. falciparum* case—as was ethically required during the trials—the *P. falciparum* transmission was interrupted. Although this complicated the vaccine trials, it provided new insights for those fighting malaria. Together with Agostinho Marquez and Carlos Catão of the Brazilian Ministry of Health, and consultant Hernando Cardenas, PAHO developed the strategy to shift the emphasis of the *P. falciparum* control. It moved away from a single-minded focus on vector control and toward the expansion of basic health services for early detection and prompt treatment: "Emphasis shifted from the mosquito to the people" (R. Gusmao, personal communication, July 2006). With good health service coverage, as basic health facilities increased from about 400 to about 35,000 in a few years, the program was able to interrupt *P. falciparum* transmission.

At the same time, Brazilian public health officials detected an increase in the resistance of *P. falciparum* to the traditional, quinine-based antimalarials. Thus, the program introduced new antimalarials (mefloquine plus artemisinin) and new diagnostic procedures. Because one form of the disease, *P. vivax*, was still sensitive to older, cheaper antimalarials, and program managers were keen to reserve the newer products for those suffering from *P. falciparum*, the deadlier form of the disease, emphasis was placed on the introduction of dipsticks, a new diagnostic procedure.

Although the oscillatory pattern of malaria incidence complicates the task of estimating the program's net effects, clear gains were made against the problem of malaria in the Amazon basin over the course of

**(continued on next page)**

## Box 12–1

## Combating Malaria in Brazil (continued)

the World Bank-financed program. By 1996, the program had shown a decrease in malaria morbidity, from 557,787 cases in 1989 to 455,194 in 1996. Of all cases, the share attributable to *P. falciparum* declined from 47 to 29 percent. One analysis estimated that about 1.8 million cases of malaria and 230,000 deaths were averted by the program, with equal credit for health gains due to preventive and curative activities.[5,6]

Brazil's ability to combat malaria and to adapt the program strategy through an expansion of case finding and treatment with new antimalarials yield inspiration for those working on the vast challenge of fighting malaria in sub-Saharan Africa, where the disease claims nearly a million lives each year.

confirmed. Between 1992 and 2001, more than 2.5 million homes were sprayed. Canisters that release insecticidal fumes when lit also have been made available to households. In many areas, house improvement schemes for the rural poor are also under way to eliminate hiding places for vector insects. Cracks and crevices in poor-quality houses have been fixed, adobe walls have been replaced with plaster, and metal roofs constructed.

The spread of the disease through the unwitting transfusion of contaminated blood is also being tackled throughout the southern cone. A decade ago, most countries in Latin America had laws or decrees mandating the screening of blood donors for infectious diseases, but enforcement was usually lax.[8] However, the HIV/AIDS epidemic heightened awareness of the need for universal screening, and technical expertise in each country has been strengthened through workshops and expert visits sponsored by the INCOSUR.[1] Blood donors have increasingly been tested to prevent the transfusion of parasite-infected blood. Today the screening of blood donors for the parasite is virtually universal in 10 South American countries.[9]

## Major Impact

To date, the INCOSUR has achieved tremendous success, and elimination of the disease as a public health problem is now close at hand in several countries. Incidence in the seven countries covered by the INCOSUR fell by an average of 94 percent, contributing to a continent-wide reduction of 70 percent by 2000. Overall, the number of new cases on the continent fell from 700,000 in 1983 to fewer than 200,000 in 2000.[3] Furthermore, the number of deaths each year from the disease was halved, from 45,000 to 22,000.

The number of endemic countries has also fallen, from 18 to 15. Uruguay was declared virtually free of vectoral transmission in 1997, and Chile followed in 1999. Children no longer suffer from acute infections in the two countries, demonstrating that disease transmission has been interrupted. Six Brazilian states where the disease had been endemic were declared free of transmission in March 2000, and another state was certified a year later. By 2001, disease transmission had been virtually halted in Uruguay, Chile, and large parts of Brazil and Paraguay, and house infestation rates decreased in Bolivia.[1]

The full social impact of Chagas disease control in Latin America has yet to be fully calculated, but it has been profound, particularly for the poorest rural communities, which have long suffered from a disproportionate burden of morbidity and mortality from the disease. In regions where vectors have been eliminated, surveys have indicated an improved sense of well-being, domestic pride, and security. Researchers suggest that a greater sense of citizenship and social inclusion may also ultimately promote the stability of rural communities.

## High Cost but Higher Benefits

Since the INCOSUR began in 1991, the countries involved have invested more than $400 million in the fight against Chagas disease. Brazil's experience demonstrates that each dollar spent has resulted in tremendous health

gains and considerable savings. Between 1975 and 1995, Brazil invested $516 million, of which 78 percent was for vector control and 4 percent for housing improvement. This investment is estimated to have prevented 2,339,000 new infections and 337,000 deaths.[3] In total, Brazil's effort prevented the loss of nearly 11.5 million disability adjusted life years (DALYs). At $39 per DALY, Chagas disease control efforts in Brazil are among the most cost-effective interventions in public health.[3]

The regional program's financial return on investment has been impressive: In Argentina, taking into consideration the reduced morbidity and the savings in medical costs, the return exceeded 64 percent. In Brazil, the benefits of the program, from savings of medical costs and disability insurance, amounted to $7.5 billion.[3] Thus, for each dollar spent on prevention in Brazil, $17 was saved from reduced medical and disability costs.[10]

## Keys to Success

International scientific and political cooperation has contributed to the notable progress against Chagas disease. Political commitment has been vital to sustained success and has ensured continued vigilance. The INCOSUR has succeeded, says Chris Schofield, for three reasons: "It was big and designed to reach a definitive end point"; "it had a simple, well-proven technical approach"; and a strong scientific community, in close contact with the government authorities, helped ensure political continuity. These lessons are now being applied in Africa in the development of the Pan African Tsetse and Trypanosomiasis Eradication Campaign.[1]

Alfredo Solari, Uruguay's former minister of health, expanded on the key elements of the program's success:

- **Peer pressure** by neighboring countries was a very positive factor. "I participated as minister of health of Uruguay in some of the annual meetings of the initiative," explained Solari. "I listened very carefully at the presentations of Argentina and Brazil, since our final success in Uruguay was dependent on their effectiveness. There was a clear sense of joint responsibility and commitment by countries with common borders. Furthermore, I know directly of at least one instance—Argentina and Bolivia in the mid-1990s—where the process was kept alive in one country by the direct involvement of a neighboring country to avoid reinfestation."
- The existence of **an international cooperative** commitment by all the countries concerned, backed up by international organizations (PAHO and WHO) able to promote trust and provide technical expertise and administrative support, was integral to the initiative's effectiveness.
- **An international technical secretariat** was also key to the initiative's success. The secretariat at PAHO was in charge of verifying surveillance, sharing information about progress of neighboring countries, processing requests to the WHO for certification of interruption and eradication, and preparing the annual meetings.
- Finally, **a favorable economic and institutional environment** in the southern cone contributed to success. The Mercado Comun del Sur (Mercosur), or Southern Cone Common Market, had just been created in 1990, and although the INCOSUR was not officially part of it, the Mercosur process favored policy coordination in other health areas among southern cone countries. "The economies of all countries in the region were growing quite strongly," explained Solari, "thus, enabling the fiscal resources needed to sustain these expensive national public health programs."

## Looking Ahead

The success of the INCOSUR to date has helped revitalize control campaigns in Paraguay and Bolivia, which are beginning to show tangible signs of progress.[11] At present, Central America and the Amazon region remain as the next major challenges. "Here, Chagas disease surveillance and control are in their infancy," says Joao Carlos Pinto Dias of the René Rachou Research Center at the Oswaldo Cruz Foundation in Brazil. The Andean countries of Colombia, Ecuador, Peru, and Venezuela, which currently are home to 5 million infected individuals, began a regional effort in 1997 to halt transmission. Similarly, the governments of the Central American countries Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama also pledged in 1997 to work toward elimination of the vector.[3]

Although the INCOSUR has achieved impressive success, sustaining the achievements will take vigilance. With success comes the inevitable tendency to relax surveillance and withdraw resources, with a subsequent loss of awareness and expertise. To ensure long-term success in the southern cone, existing programs need continued political support over the next decade so that achievements can be consolidated rather than reversed. Projections during the initial planning of the INCOSUR showed that premature curtailment of active surveillance could cause a radical decline in the total benefits, reaching zero after just 11 years. As with many diseases, the battle against Chagas disease is a long one, requiring persistent support after the first gains have been made.

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