

Brazil



The History of Schistosomiasis in Brazil

In Brazil, the only human schistosome is *Schistosoma mansoni*, and host snails include *Biomphalaria glabrata* (primary intermediate host), *B. straminea* (alternative intermediate host, in northeast), and *B. tenagophila* (alternative intermediate host) [1]. These snails thrive on conditions created in the process of deforestation and 'moderate pollution of water collections', as they have been shown to be drawn to detritus resulting from human activity [2]. Schistosomiasis was introduced to Brazil during the transport of African slaves sometime between 1550 and 1646, and the first establishment of schistosomiasis in Brazil most likely occurred between these years in a community of escaped slaves in the jungle region of Palmares [1]. The first scientifically reported case of schistosomiasis was discovered in the state of Bahia in 1907 [3]. With further human development in Brazil starting in the 1930s, most human populations from this now-endemic region around Palmares migrated to other areas of the country, like Touros in the north and the Sao Francisco Valley in the south [1].

Schistosomiasis in Brazil [12]

Over **1 million** children were treated for schistosomiasis in 2013.

<1% of the population requires preventive chemotherapy for schistosomiasis

Brazil targets primarily **school-age children** in its schistosomiasis prevention programs.

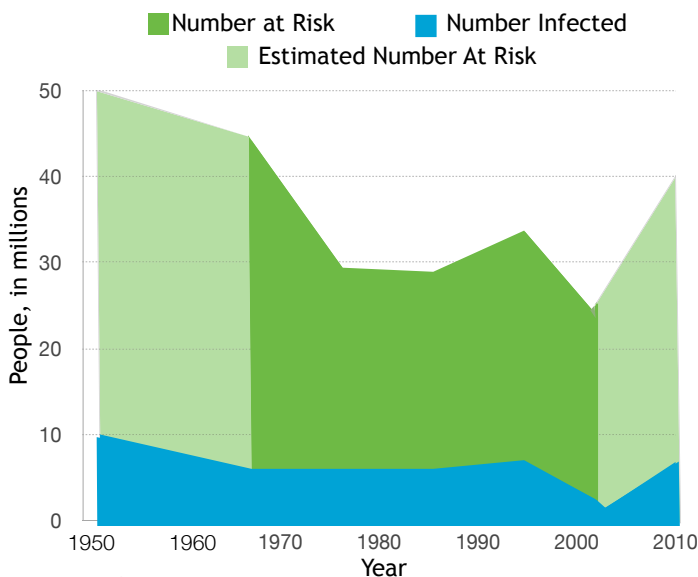
Overview of Brazil [13]

- » Population in 2015: 204,259,812
- » Official Language: Portuguese
- » Capital: Brasilia
- » Federal Republic
- » Percentage of Population with Access to Improved Drinking Water in 2012: 97.5%
- » Percentage of Population with Access to Improved Sanitation in 2012: 81.3%

History -- continued

A nationwide health survey from 1937-1946, the primary purpose of which was to determine the incidence of yellow fever, found lesions indicative of *S. mansoni* in 2.3% of the 267,102 livers they dissected [4]. A national survey of Brazil published in 1953 by Pellon and Teixeira led Machado to estimate 8-12 million infected Brazilians at that time [1]. From the mid-1960s through the 1970s, there was a rapid spread of the disease's range brought on by the spread of 'hydroelectric power plants and agropastoral projects', human migration, and poor sanitation [2]. In the 1960s, there were a number of small experimental control programs performed in various endemic locations (e.g. Barbosa, Pinto & Souza 1971; Bina & Prata 1970; Coutinho, Lima & Alves 1966). By 1968, it was estimated that 46 million Brazilians were exposed to schistosomiasis and 6 million were infected [5]. At the same time an increase in schistosomiasis due to migration from the northeast to southern states like Sao Paulo and Parana was reported [5]. Before the national control program was implemented in 1975, there was no systematic attempt to control the disease, and the only drug available, hycanthone, was only used on an individual basis, mostly in a clinical setting due to adverse side effects [1].

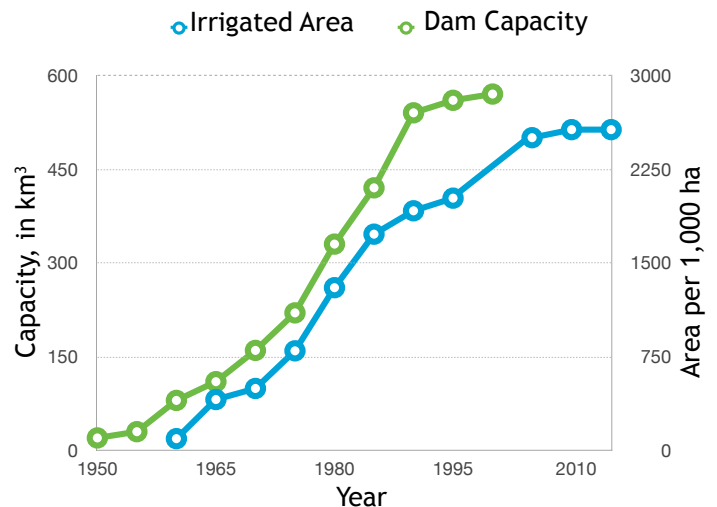
Disease Prevalence in Brazil, per million people



Integrated Control Program, 1975-1979 -- Phase 1

In 1975, coordinated country-wide schistosomiasis control plans were drawn up for the Special Program for Schistosomiasis Control (PECE) by the Brazilian Ministry of Health; the strategy was integrative and included chemotherapy, mollusciciding, sanitation improvements, and health education [1]. In 1976, the PECE program began with the objective 'to find the breaking point with the aim of disease control and, wherever possible, transmission control' [1]. The first phase of the program (preparatory phase) involved thorough mapping of particular areas suspected to be endemic, including demographic surveys and schistosomiasis tests using the Kato-Katz method, as well as initial health education programs [1]. Control teams also monitored snail breeding sites for their seasonality to assess the best season to use niclosamide [1]. However, relatively strict Brazilian environmental laws have traditionally limited mollusciciding in the country [6].

Water Use in Brazil



Disease Prevalence and Water Use in Brazil

(Above) Water use in Brazil has increased over the past decades. Water development, especially damming and irrigation, is linked to schistosomiasis.

(Left) Schistosomiasis prevalence in Brazil has been tumultuous over the years. Only known data is plotted in the darker shades -- the lighter green reflects an estimate.

Integrated Control Program, 1975-1979 -- Phases 2-4

The second phase (attack phase) involved mollusciciding with the goal of reducing snails to 1% of previous levels and mass chemotherapy with oxamniquine (the PECE treated about 2.7 million people with this drug between 1976 and 1979) [1]. There was also an ongoing sanitation campaign at the time (the Basic Sanitation Project, active from 1968-1986) that had the goals of providing laundry and shower facilities, pit latrines, and a potable water supply to homes throughout the country. In the third phase (consolidation phase), snail populations were monitored every 6 months and molluscicide was applied as needed. A test and treat strategy was implemented in the affected human communities, with positive patients treated with oxamniquine [1]. Those sites with 2 consecutive surveys showing 0% prevalence or 3 consecutive surveys showing 4% or less prevalence entered the fourth stage, the surveillance phase. In this phase, control was transferred to the locality, and children were tested and positive cases were treated annually [1]. By 1976, the Brazilian government was spending 1.9% of their national health budget (4.5 million USD out of 317.4 million USD) on schistosomiasis control [7]. In 1980, the PECE program was downgraded as the Ministry of Health's most important project and control efforts were reduced [3]. In the first round of treatment in 1976 (six months after treatment), prevalence was reduced from 20.6% to 15.6% [1]. However, a seemingly more rigorous analysis from long after the program (1992) found that, upon examination at the 'micro-level', prevalence decreases were associated with higher socio-economic status and improved housing, sanitation, and water supply; transmission rates did not abate in many poorer neighborhoods, while egg counts tended to return to former levels within 6-12 months [8].

Recent Control Efforts in Brazil

By the 1980s, amidst a worldwide shift in focus from integrated schistosomiasis control to more drug-based focus on morbidity control, as recommended by the World Health Organization, the PECE program changed its primary goal to 'reducing prevalence rates of the hepatosplenic form of the disease.' This focus on just severe disease signaled an abandoning of the previous 'integrated program' aimed at reducing prevalence [2]. Between 1988 and 1991, the number of people tested for schistosomiasis decreased, the success of the control program stalled and the percentage of positive cases increased.

Before the national control program was implemented in 1975, there was no systematic attempt to control schistosomiasis

This was likely due to provinces scaling back their schistosomiasis control efforts, possibly due to the fact that much of the Brazilian public health effort at the time was directed toward a devastating outbreak of dengue fever. This de-emphasis on the formerly successful integrated control program, coupled with a diversion of resources towards dengue and other concerns, may have halted, by the late 1980's, the continuous downward trend in schistosomiasis prevalence that had been observed since the mid 1970s in Brazil [3]. In 1989, approximately 6 million Brazilians were infected with schistosomiasis [9]. In 1990, government schistosomiasis control was expanded to the areas of Bahia and Minas Gerais, which had become heavily burdened by that time [3]. In 1993, schistosomiasis control was decentralized, and it became the responsibility of local municipalities to deal with the disease [3], but prevalence surveys of endemic areas were still performed [6]. This decentralization weakened access to diagnosis and care in some rural areas [6].

The Current Situation

As of 1998, oxamniquine was still the primary drug of choice for schistosomiasis treatment in Brazil. Despite oxamniquine being three times the cost of praziquantel and strong pressure from the World Bank to switch, the country's health programs never switched from oxamniquine to praziquantel because (1) Brazil had become accustomed to oxamniquine, (2) there were concerns among physicians that praziquantel pills were large and hard for children to swallow, and (3) there remained an oxamniquine packaging plant in Brazil, making the drug familiar and locally available [10]. Approximately 7.01 million people were infected in Brazil in 1995 [11]. There was only 0.8% prevalence nationwide in 2003, but there appears to have been a resurgence in the 2000s, and in 2010 an estimated 6.8 million people were infected, with 3.4% nationwide prevalence [6].

Despite international pressure and higher expenses, Brazil still uses oxamniquine to treat schistosomiasis, not the widely-used drug praziquantel.

References

1. Almeida Machado, P. The Brazilian program for schistosomiasis control, 1975-1979. *Am. J. Trop. Med. Hyg.* **31**, 76-86 (1982).
2. Barbosa, F. S., Sanches, O., Barbosa, C. S. & Arruda, F. Dynamics of snail populations of *Biomphalaria glabrata* and *B. straminea* under semi-natural conditions. *Cad. Saude Publica* **8**, (1992).
3. Amaral, R. S. do, Tauil, P. L., Lima, D. D. & Engels, D. An analysis of the impact of the Schistosomiasis Control Programme in Brazil. *Mem. Inst. Oswaldo Cruz* **101**, 79-85 (2006).
4. Coura, J. R. & Amaral, R. S. Epidemiological and control aspects of schistosomiasis in Brazilian endemic areas. in *Mem. Inst. Oswaldo Cruz* **99**, 13-19 (2004).
5. Wright, W. H. Schistosomiasis as a World Problem. **44**, (1968).
6. Rollinson, D. et al. Time to set the agenda for schistosomiasis elimination. *Acta Trop.* **128**, 423-440 (2013).
7. Iatroski, L.S. and Davis, A. The schistosomiasis problem in the world: results of a WHO questionnaire survey. *Bull. World Health Organ.* **59**, 115-127 (1981).
8. Kloetzel, K. Some personal views on the control of schistosomiasis mansoni. *Mem. Inst. Oswaldo Cruz* **87 Suppl 4**, 221-226 (1992).
9. Utroska, J.A., Chen, M.G., Dixon, H., Yoon, S., Helling-Borda, M., Hogerzeil, H.V., Mott, K. E. *An Estimate of Global Needs for Praziquantel within Schistosomiasis Control Programmes.* *whqlibdoc.who.int* at <http://whqlibdoc.who.int/HQ/1989/WHO_SCHISTO_89.102_Rev1.pdf>
10. Reich, M. R. et al. *International strategies for tropical disease treatments: Experiences with praziquantel.* WHO (1998). at <<http://apps.who.int/medicinedocs/pdf/whozip48e/whozip48e.pdf>>
11. Chitsulo, L., Engels, D., Montresor, a. & Savioli, L. The global status of schistosomiasis and its control. *Acta Trop.* **77**, 41-51 (2000).
12. WHO. PCT Databank for Schistosomiasis. at <http://www.who.int/neglected_diseases/preventive_chemotherapy/sch/en/>
13. Central Intelligence Agency. (2014). Brazil. In *The World Factbook.* at <<https://www.cia.gov/library/publications/the-world-factbook/geos/br.html>>