SCHISTOSOMIASIS: EPIDEMIOLOGICAL ANALYSIS IN THE FIVE REGIONS OF BRAZIL

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Raquel da Silva Machado Azevedo[1], Keyla Nunes Farias Gomes[2], Leandro Rocha[3] and Robson Xavier Faria[4]

ABSTRACT

Schistosomiasis is a parasitic disease caused by the helminth Schistosoma mansoni, which affects approximately 240 million people globally, with Brazil being the most affected country in the Americas, with 1.5 million infected people. The prevalence of this disease is associated with unfavorable socioeconomic conditions and poor basic sanitation. This study aimed to evaluate the epidemiological profile of cases of S. mansoni infection in five regions of Brazil (Northeast, North, South, Southeast and Central-West) between 2010 and 2021. Data from the Schistosomiasis Control Program Information System (PCE) and the Notifiable Diseases Information System (SINAN) were used to analyze variables such as sex, age group, race and incidence by region. The results revealed that schistosomiasis is more common in Northeast, where the combination of unfavorable economic conditions and the presence of snails of the genus Biomphalaria contribute to its spread. In contrast, South and parts of Southeast a lower incidence, which was attributed to better sanitary conditions. The infection predominantly affects men, especially those involved in activities in contact with potentially contaminated aquatic environments, such as fishing and agriculture, who seek medical care less frequently. The most affected age group varies in North, between 40 and 59 years old, and in Northeast, this age group stands out between 2015 and 2021. These data highlight socioeconomic inequalities in the prevalence of the disease, with a higher incidence among people of mixed race in North, Northeast, Southeast and Central-West in South the prevalence is higher among whites. The persistence of schistosomiasis in Brazil highlights the need for control strategies according to the regional epidemiological profile. Schistosomiasis continues to be an important public health problem in Brazil, requiring strategies that prioritize basic sanitation, health education, treatment and epidemiological surveillance to reduce transmission and improve the quality of life of affected populations.

Keywords: Public health. Parasitic disease. Epidemiological data. Brazilian regions.

[1] Estácio de Sá University - Bachelor's Degree in Biomedicine, Shopping Floors – Portela Road, 222 – 5, 6, 7 – Madureira, Rio de Janeiro – RJ, 21351-900.
[2] Federal University of Rio de Janeiro – Postgraduate Program in Plant Biotechnology and Bioprocesses, Center of Health Sciences, Avenida Carlos Chagas Filho 373 – University City, CEP 21941-902, Rio de Janeiro, RJ, Brazil.
Federal Fluminense University - Natural Products Technology Laboratory, Mário Viana Street 523, Zip Code 24241-002, Niteroi, RJ, Brazil.
Laboratory for the Assessment and Promotion of Environmental Health, Oswaldo Cruz Foundation (Fiocruz), Av. Brasil 4365, CEP 21040-900, Rio de Janeiro, RJ, Brazil.
[3] Federal University of Rio de Janeiro – Postgraduate Program in Plant Biotechnology and Bioprocesses, Center of Health Sciences, Avenida Carlos Chagas Filho 373 – University City, CEP 21941-902, Rio de Janeiro, RJ, Brazil.
Federal Fluminense University - Natural Products Technology Laboratory, Mário Viana Street 523, Zip Code 24241-002, Niteroi, RJ, Brazil.
[4] Laboratory for the Assessment and Promotion of Environmental Health, Oswaldo Cruz Foundation (Fiocruz), Av. Brasil 4365, CEP 21040-900, Rio de Janeiro, RJ, Brazil.

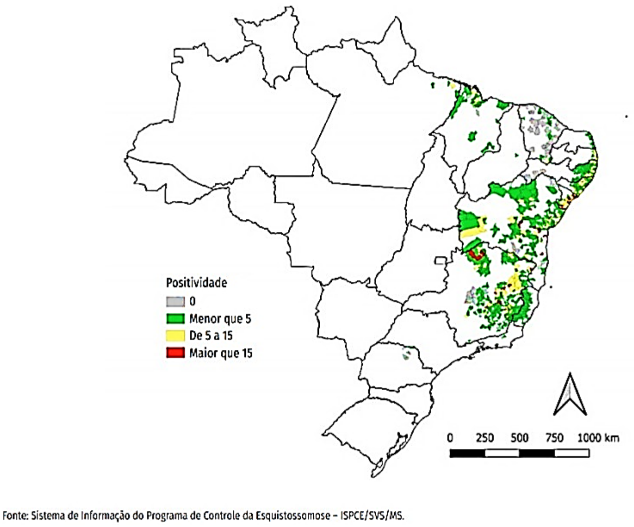
INTRODUCTION

The emergence of parasitic diseases is directly related to the precarious conditions of the population, especially the lack of adequate basic sanitation. Parasitic diseases are a problem for public health, as they affect thousands of people worldwide (Melo et al., 2019). Schistosomiasis is the second most important parasitic disease worldwide, behind only malaria (Rocha et al., 2016).

It is popularly known as schistosomiasis, water belly or snail disease (Rangel et al., 2023). Schistosomiasis was introduced into Brazil through the slave trade originating from the west coast of Africa, which entered the country mainly through the ports of Recife and Salvador to work on sugarcane plantations (Melo et al., 2019). According to the World Health Organization, schistosomiasis affects almost 240 million people worldwide, and more than 700 people live in endemic areas (WHO, 2024).

This disease is found mainly in Africa and the Eastern Mediterranean and affects Nile Delta regions and countries such as Egypt and Sudan. In the Americas, it affects South America, with emphasis on the Caribbean region, Venezuela and Brazil (Ministry of Health, 2024). Brazil is the most affected country in the Americas, with 1.5 million infected people (Figure 1) (Ministry of Health, 2014; Paz et al., 2021).

Figure 1: Distribution of schistosomiasis in Brazil in 2020 according to percentage of positivity by municipality. Brazil, 2009–2020. Source: Schistosomiasis Control Program Information System ISPCE/SVS/MS. Accessed on: 08/24/2021.



The Northeast Region and the state of Minas Gerais were the first endemic areas of schistosomiasis mansoni in Brazil. In Southeast, isolated foci have appeared in Rio de Janeiro, Espírito Santo and São Paulo. The northern region of Paraná, which is in southern Brazil, has also become an endemic area. Three other foci of the disease were recently described in two other southern states: two in Santa Catarina and one in Rio Grande do Sul

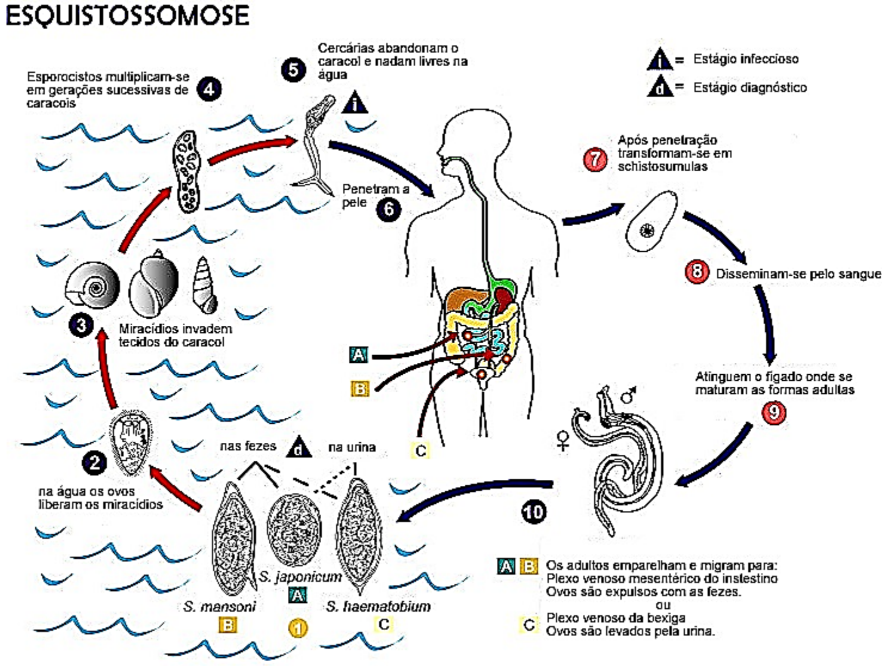
(Katz and Almeida, 2003).

In 2015, Nascimento and collaborators began a study on the costs of schistosomiasis caused by *S. mansoni* in Brazil. For the analysis, they used data from the Unified Health System (SUS).

The neurological and hepatosplenic forms of the disease, severe cases and those that resulted in death were analyzed (Nascimento et al., 2019). The parameters for analyzing the costs of this endemic disease were medical records and interviews with hospital patients; scientific literature; the management system for procedures, medications, prostheses and special devices of the Unified Health System; the price database of the Brazilian Department of Health; the websites of the Planning Secretariat, the Health Secretariat, the State and Municipal Health Secretariats; Public Acquisition Offers; and clinical protocols. Through these parameters, some authors estimated the total cost of this disease in Brazil at US$ 41.7 million, with 94.61% of these costs being indirect (Nascimento et al., 2019).

The schistosomiasis life cycle involves two hosts, the intermediate being the mollusk and the definitive being the human (Adekiya et al, 2019). The definitive host releases eggs in feces or urine into the aquatic environment, which gives rise to miracidia, known as the first larval stage of the parasite. The miracidia infect the intermediate host (snail), where they develop until the second larval stage. The cercariae, known as the second larval stage, penetrate the skin of the definitive host (human), transform into schistosomula and spread through the blood, reaching the mesenteric tract, where the worms mature to the adult stage (Figure 2) (Adekiya et al, 2019; Aula et al., 2021).

Figure 2: Schistosomiasis cycle. Source: Center for Disease Control and Prevention (https://www.cdc.gov/dpdx/schistosomiasis/index.html). Accessed on: 03/19/2024.



This endemic disease presents itself in acute and chronic forms. In the acute form, it may be asymptomatic or symptomatic. In some cases, the asymptomatic form makes diagnosis difficult, as it can be confused with other diseases. The symptomatic form may present symptoms such as cercarial dermatitis or itching, characterized by erythematous and pruritic micro papules such as insect bites, and contact eczema (Ministry of Health, 2014). In the chronic form, embolism may occur in the liver and spleen (Carbonelletal., 2021).

The World Health Organization (WHO) has recommended the use of an anthelmintic drug called praziquantel (PQZ) for the treatment of this endemic disease (Aula et al., 2021). Praziquantel is a pyrazine-isoquinoline product that is a colorless powder with a bitter taste. This drug is commercially known as Biltricide® (Klohe et al., 2021).

Tesfie and collaborators (2020) conducted a study at Sanja General Primary School from March to April 2017 involving 245 school-aged children (6 to 18 years) infected with *S. mansoni*. After 4 weeks of treatment, new samples were collected to assess the effectiveness of the treatment because of the cure rate. Before treatment with praziquantel, the prevalence of infection was 83.3%, with 26.5% in the mild form, 37.3% in the moderate form and 36.3% in the severe form. After 4 weeks of treatment, this prevalence decreased to 10.8%.

In 2014, Papazian et al. conducted a study in which the therapeutic efficacy of praziquantel (PZQ) was evaluated in school-aged children in Brazil in relation to *S. mansoni* infection. The results indicated that PZQ was highly effective, with an egg reduction rate of

93.4%, which confirms its effectiveness in reducing the parasite load. However, the study also revealed variations in the efficacy of PZQ, possibly due to the different Schistosoma species analyzed. This variability highlights the importance of continuous monitoring of treatment efficacy. The data obtained provide a valuable basis for comparisons in future studies on the efficacy of PZQ in Brazil and other countries, allowing the early detection of any reduction in the efficacy of the drug, which could be due to the emergence of resistance.

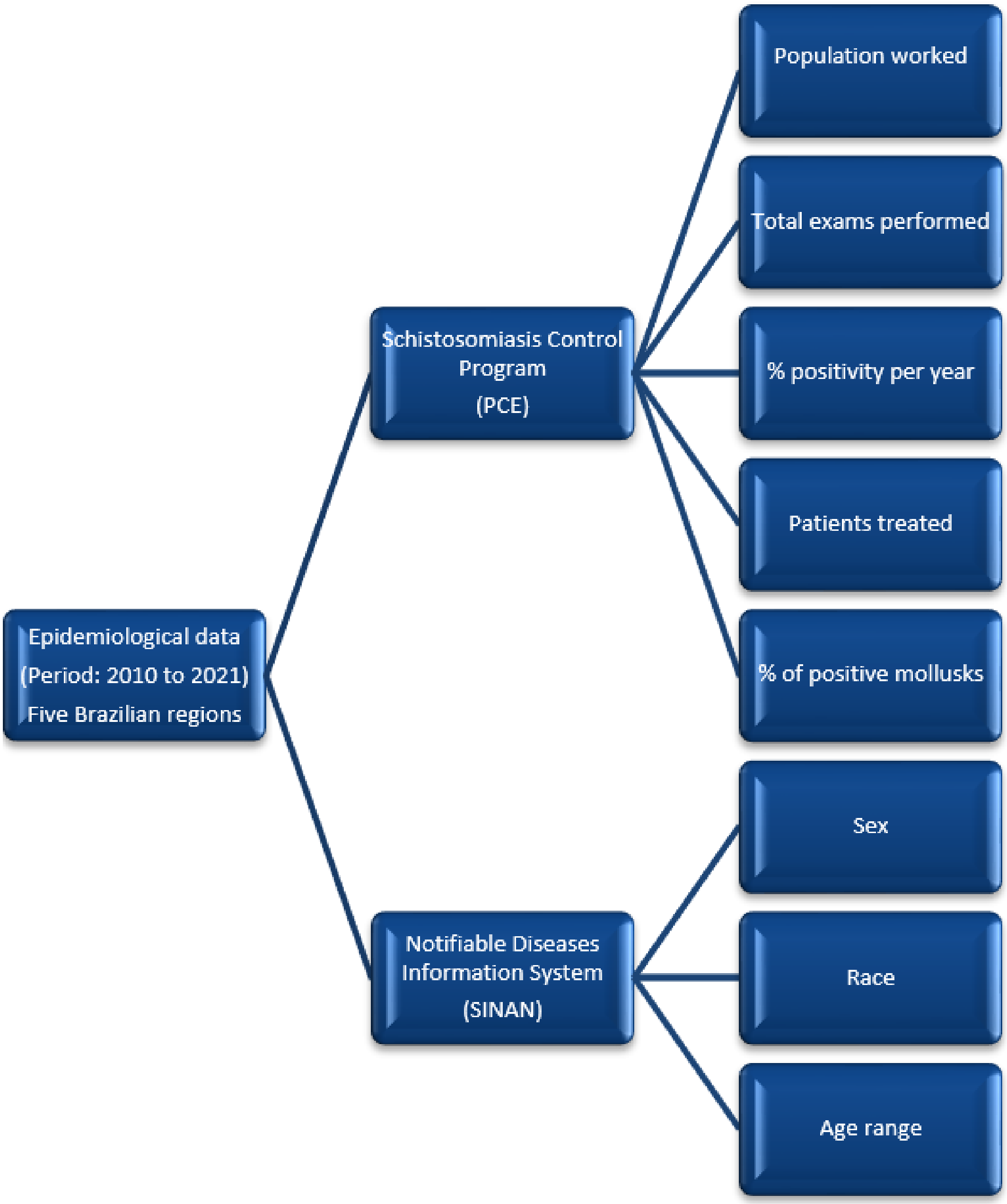
Despite continued efforts to administer mass-administer praziquantel (PZQ), the standard treatment for decades, schistosomiasis persists owing to limitations such as PZQ's ineffectiveness against juvenile forms of the parasite and its inability to prevent reinfection. These shortcomings highlight the urgent need for complementary control strategies, including the development of an effective vaccine. As discussed by Molehin (2020), the integration of a viable vaccine into current control measures represents the best opportunity to achieve long-term elimination of schistosomiasis. Although vaccine development has faced significant challenges, advances in preclinical research and human clinical trials provide an optimistic outlook for the future of immunization against this disease.

Scientific contributions to the understanding of schistosomiasis have been significant, but there is still a clear need for further studies, especially in endemic regions, to assess local conditions, functions and results of control measures. This study aims to evaluate the epidemiological profile related to positive cases of *Schistosoma mansoni* infection in five Brazilian regions (Northeast, North, South, Southeast and Central-West) from 2010--2021, analyzing the incidence of reported cases and the impact of the schistosomiasis control program in the five regions of Brazil.

METHODOLOGY

This descriptive, quantitative study was carried out with data from the Schistosomiasis Control Program Information System (PCE) and the Notifiable Diseases Information System (SINAN). The data collection included independent variables such as the number of people studied, positive cases, number of people treated, and malacological information from 2010--2021. The prevalence of schistosomiasis was also included, which was based on factors such as sex, age group, and race, and a study was realized during the same period (Figure 3).

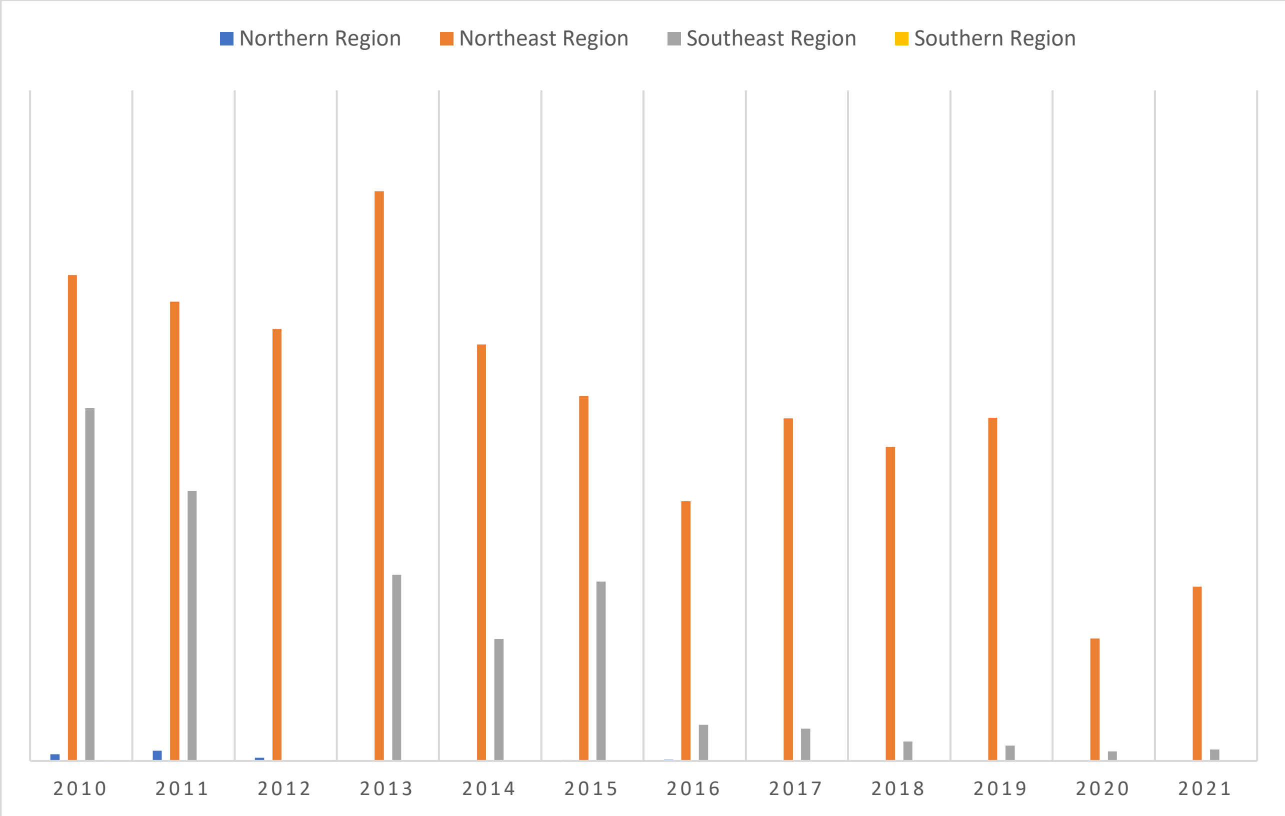
Figure 3: Descriptive organizational chart of the selection process in the databases of the Schistosomiasis Control Program (PCE) and the Notifiable Diseases Information System (SINAN).



RESULTS AND DISCUSSION

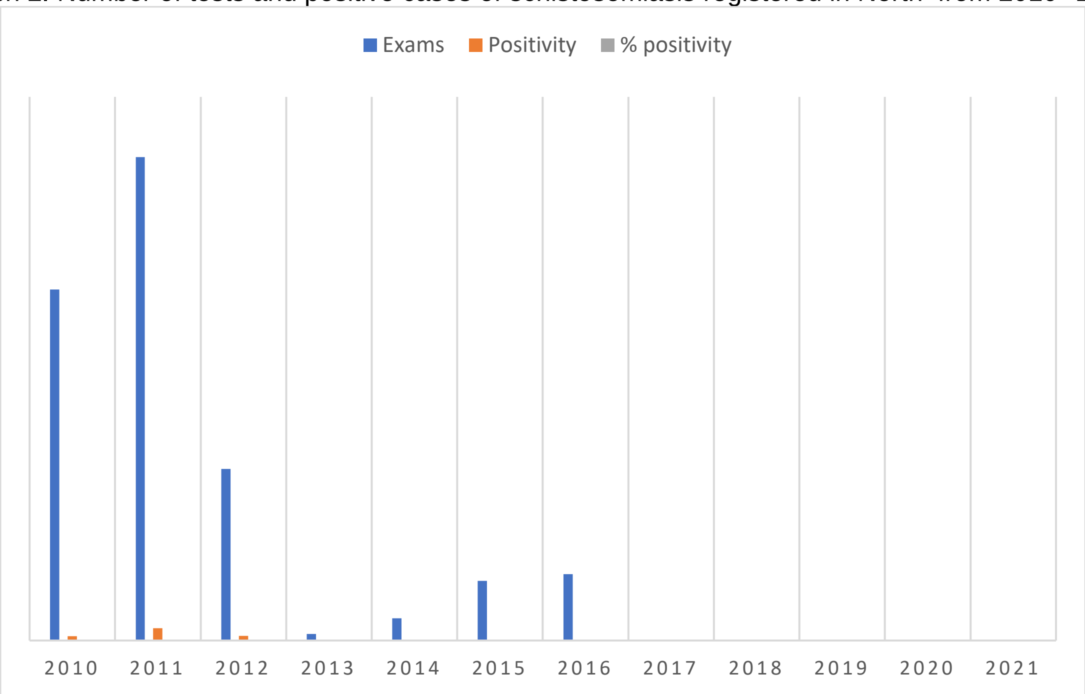
Epidemiological results of schistosomiasis in Brazil reveal a high incidence of the disease in certain regions of the country. According to data from DATASUS, in 2013 and 2010, the regions with the highest prevalence of reported cases were the Northeast Region, with more than one and a half million cases, and the Southeast Region, with almost 948 thousand cases (Graph 1). As shown in the following graph:

Graph 1. Number of reported cases of schistosomiasis registered in the four Brazilian regions from 2010--2021.

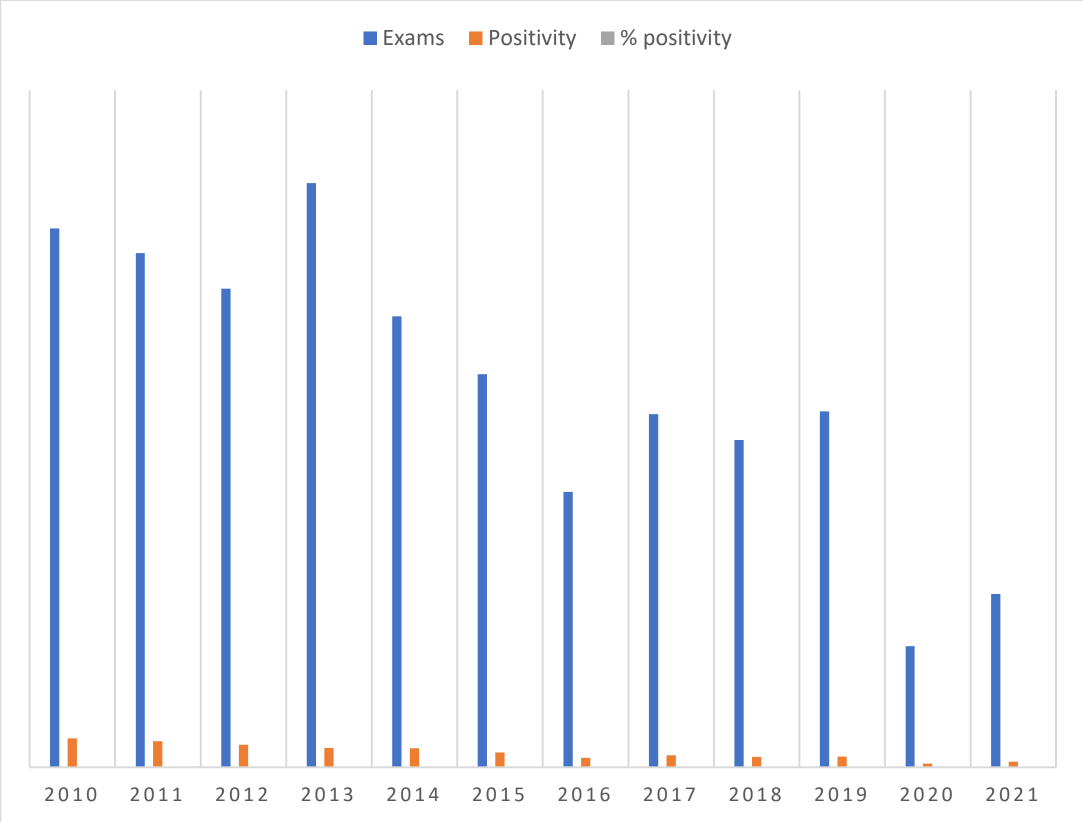


Diagnostic methods used to detect schistosomiasis in Brazil include stool analysis to identify the eggs of the parasite *Schistosoma mansoni* in the collected samples. The positivity of this test may vary according to the geographic region and the epidemiological profile of the population examined, as seen in the graphs (Graph 2, 3, 4, 5):

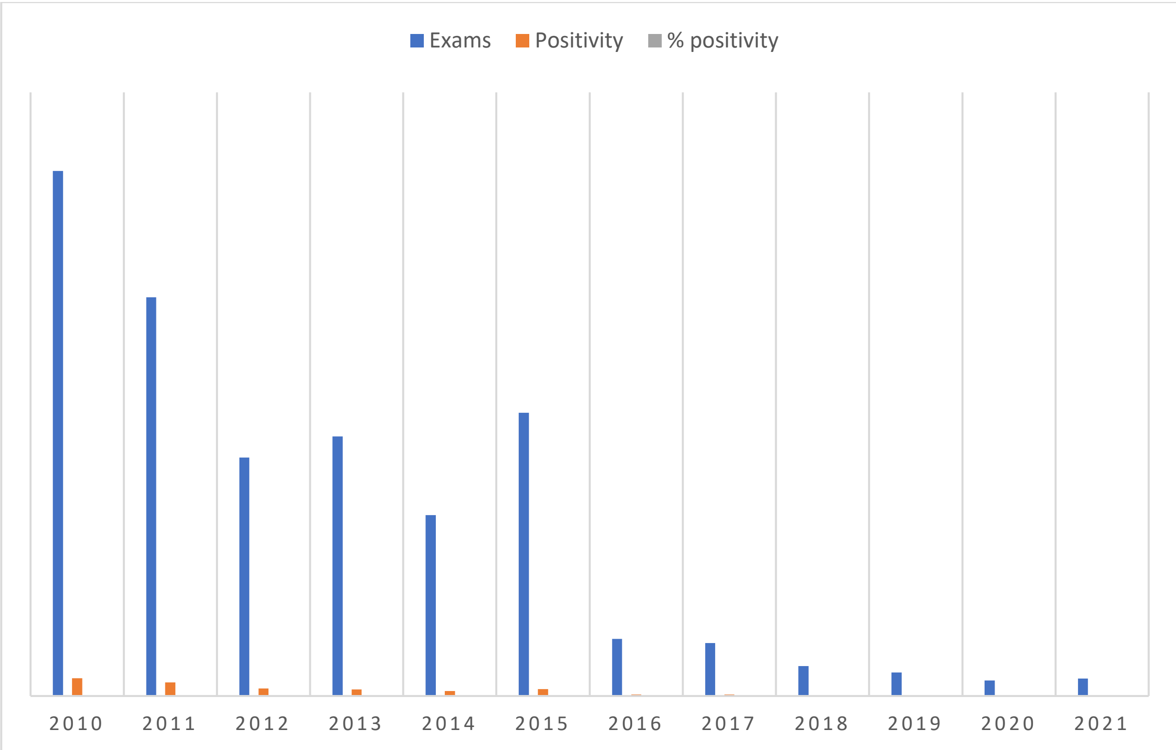
Graph 2. Number of tests and positive cases of schistosomiasis registered in North from 2010--2021.



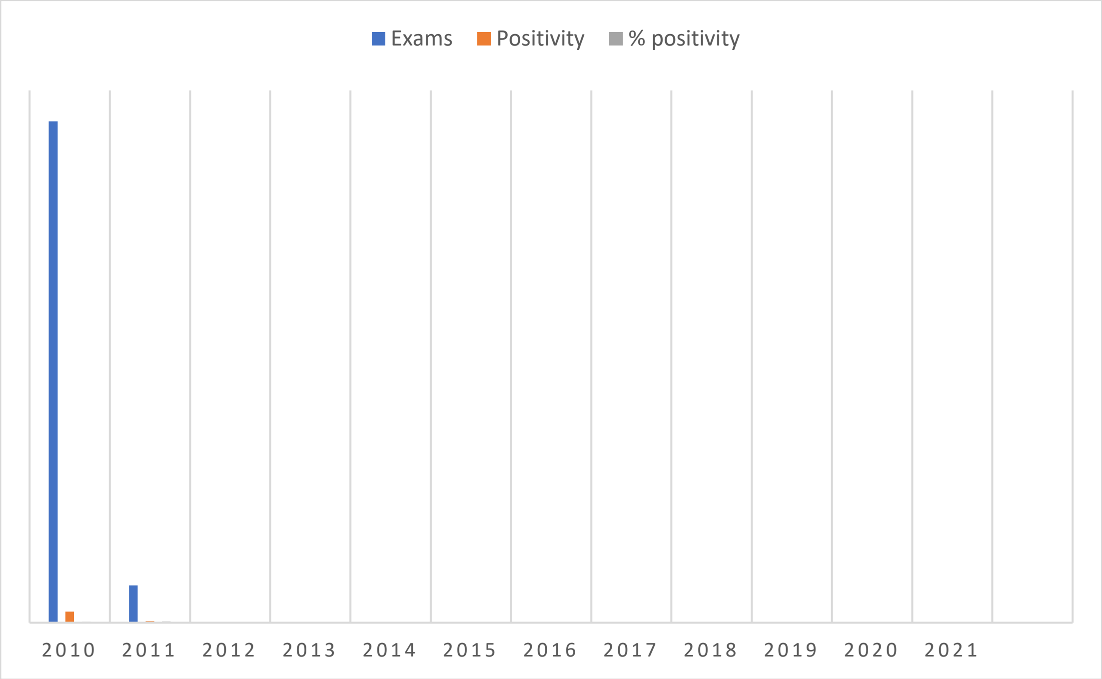
Graph 3. Number of tests and positive cases of schistosomiasis registered in Northeast from 2010--2021.



Graph 4. Number of tests and positive cases of schistosomiasis registered in Southeast China from 2010--2021.



Graph 5. Number of tests and positive cases of schistosomiasis registered in the southern region from 2010--2021.

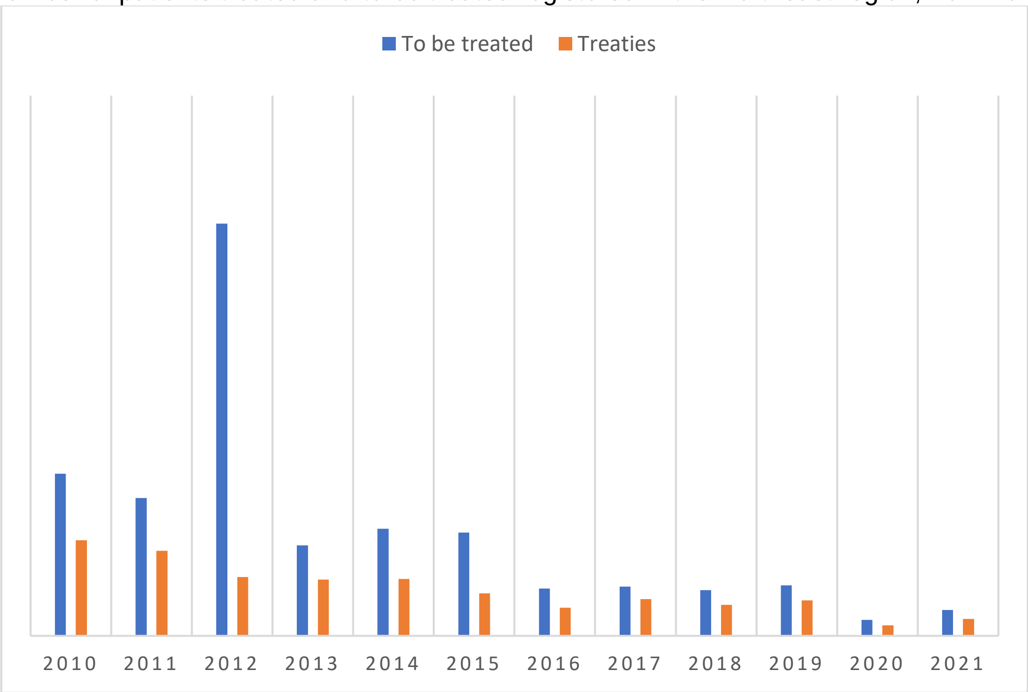


In 2010, the Northeast Region had more than nine hundred thousand tests performed and almost 52 thousand positive results, and 2013 was the year with the highest incidence, with the same region having more than one million cases and almost 35 thousand positive results. However, in all regions, both the number of tests performed and especially the number of confirmed cases have been decreasing. In some regions, there are no cases, such as South and North.

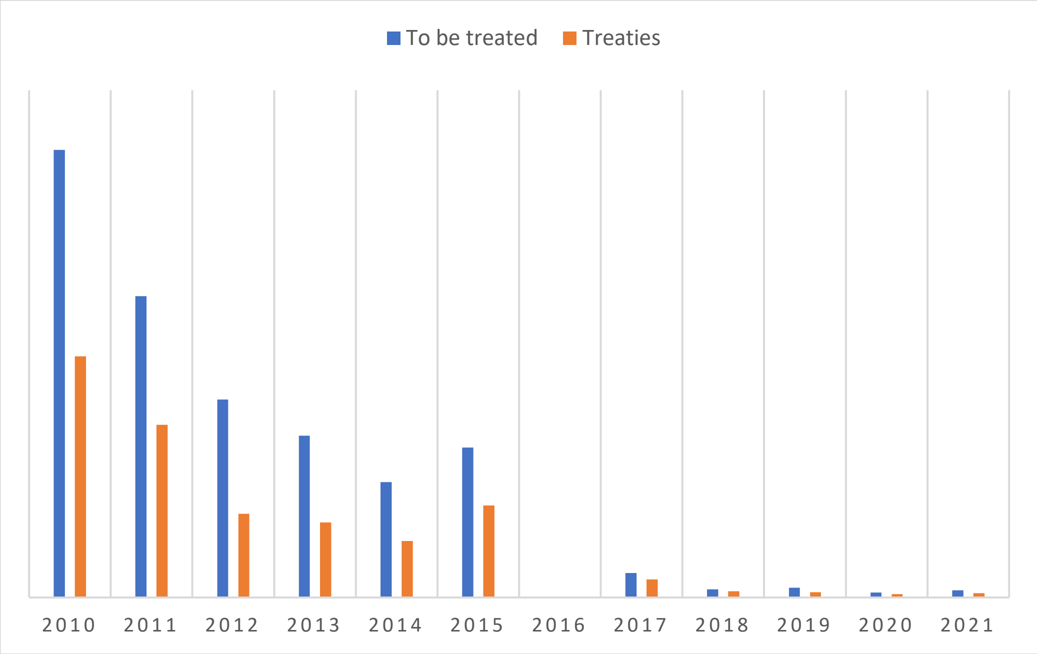
With respect to patients treated and to be treated, Brazil implements schistosomiasis control programs that aim to serve both patients who have already been diagnosed with the disease and those who are in endemic areas and are considered at risk of infection (Graph 6, 7, 8, 9). Let us see the following graphs:

Graph 6. Number of patients treated and to be treated registered in the North region, from 2010 to 2021.

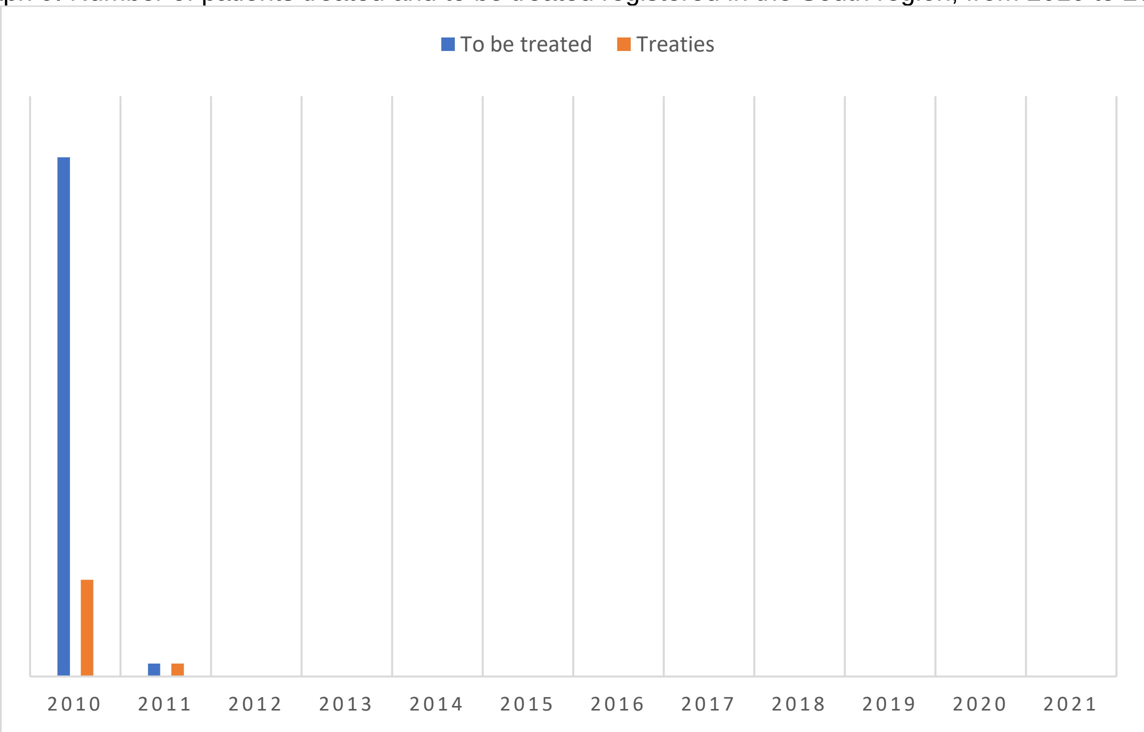
Graph 7. Number of patients treated and to be treated registered in the Northeast region, from 2010 to 2021.



Graph 8. Number of patients treated and registered treatments in the Southeast region, from 2010 to 2021.



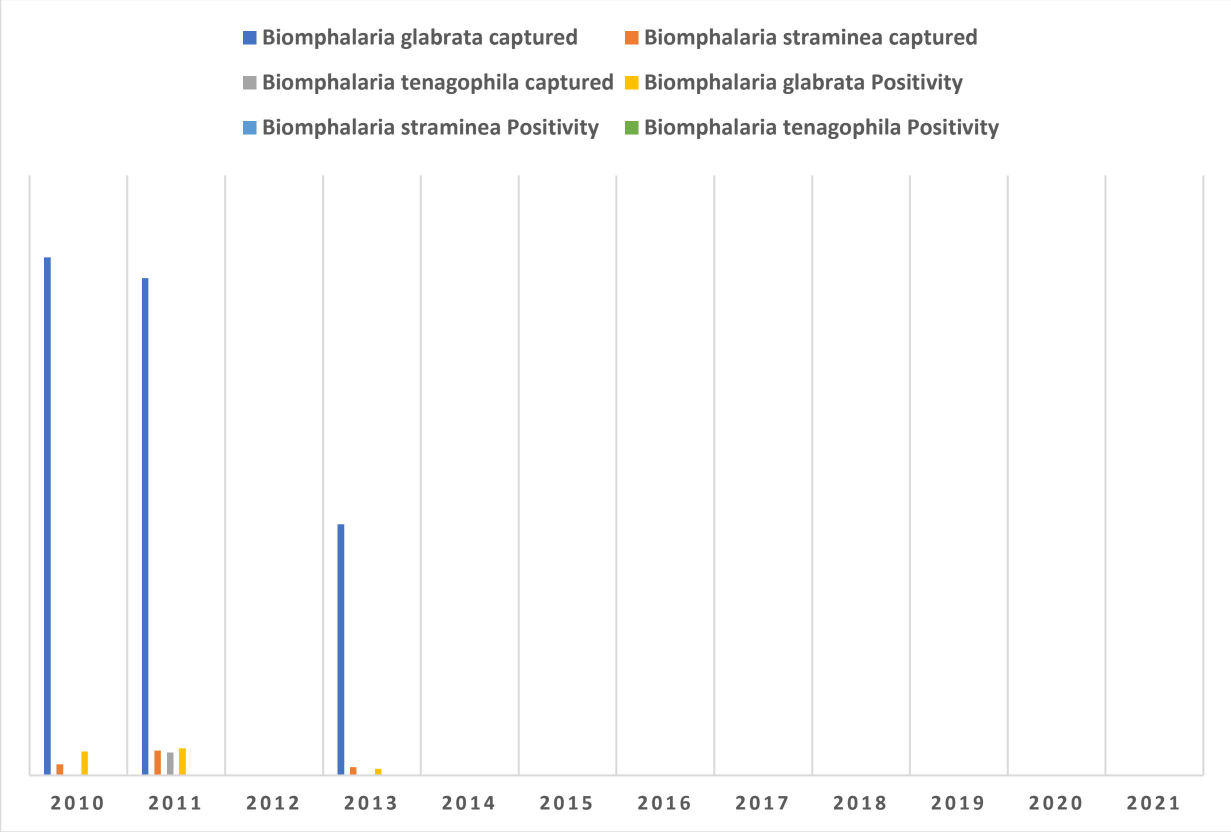
Graph 9. Number of patients treated and to be treated registered in the South region, from 2010 to 2021.



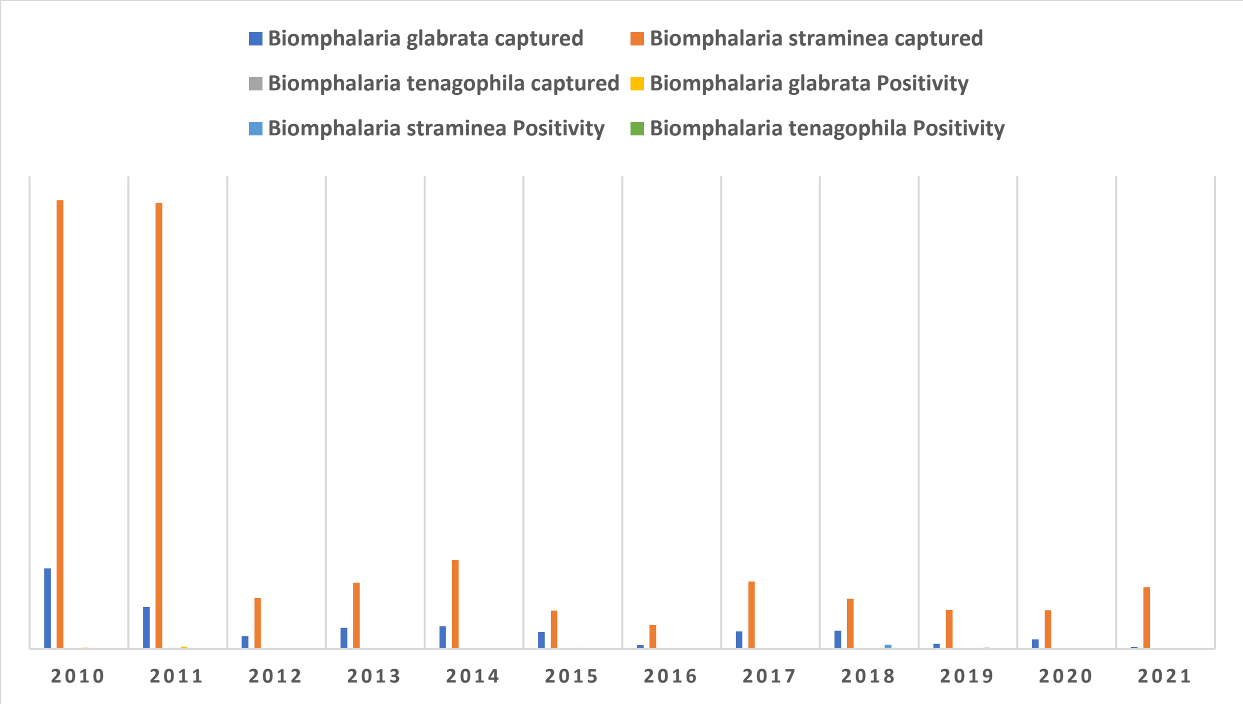
As described in the graphs, in 2010, 44126 patients were treated in the Southeast Region, with 23,764 patients treated. In 2012, the largest number of patients to be treated was in the Northeast Region, with over 190,000 patients and almost 28,000 already treated. Similar to the number of positive cases, the number of patients undergoing treatment has been decreasing over the years. In the North and South regions, no patients are receiving treatment for this disease.

The mollusks of the genus Biomphalaria (*Biomphalaria glabrata*, *Biomphalaria straminea* and *Biomphalaria tenagophila*) act as intermediate hosts for *Schistosoma mansoni* and are distributed in several regions of Brazil, especially in places with fresh water and environmental conditions conducive to its development (Graph 10, 11, 12). Let us look at the graphs to determine the number of captures and positivity of these species:

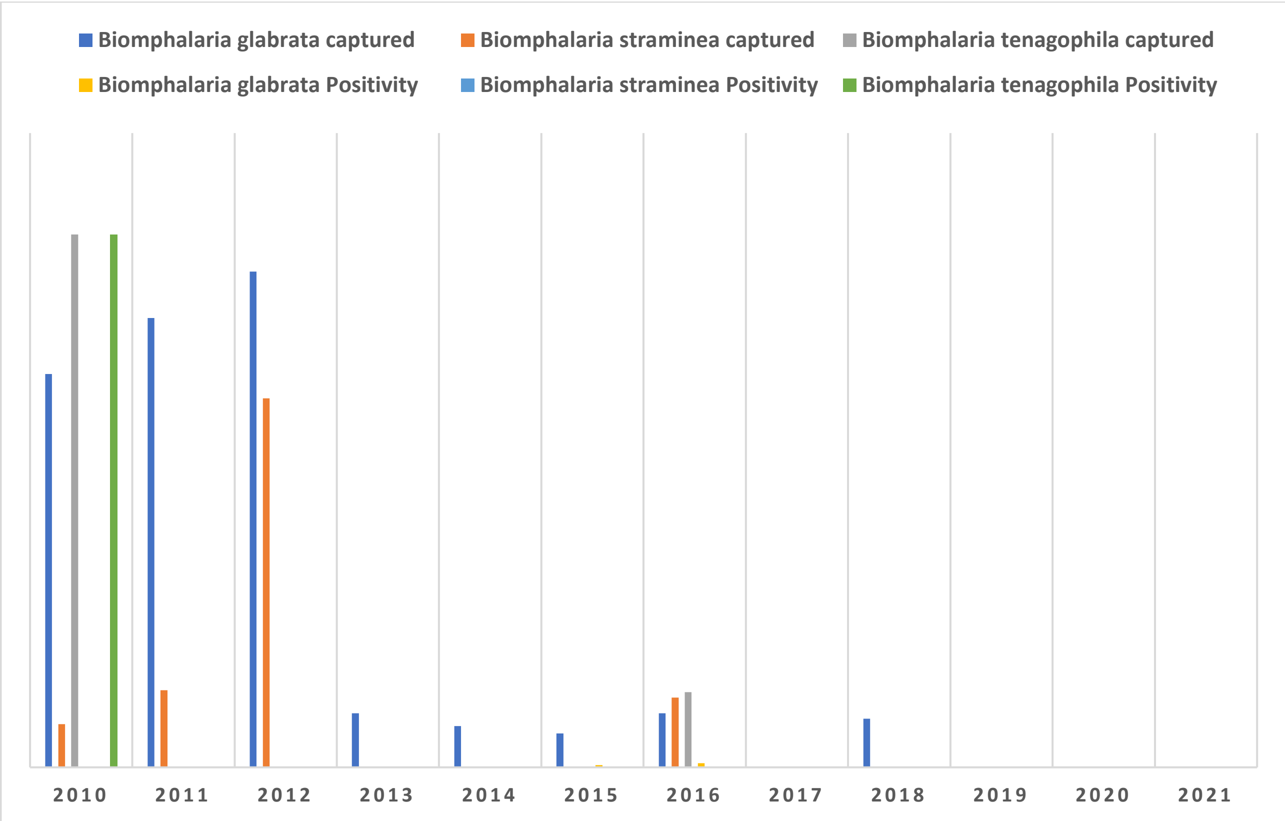
Graph 10. Number of Biomphalaria captured and positives registered in the North region, from 2010 to 2021.



Graph 11. Number of Biomphalaria captured and positives registered in the Northeast region, from 2010 to 2021.



Graph 12. Number of Biomphalaria captured and positives recorded in the Southeast region, from 2010 to 2021.



The presence of positive cases of schistosomiasis in Southeast Brazil, even with the reduction or absence of Biomphalaria species, the main intermediate host, can be explained by epidemiological and behavioral factors, in addition to challenges in controlling transmission. A common hypothesis is that many of these infections may be the result of the migration of people from endemic areas, who arrive in Southeast and are already infected and manifest symptoms later. Studies indicate that the Southeast and Northeast Regions are strongly connected in terms of population displacement, which facilitates the maintenance of cases, even in places where Biomphalaria is not currently detected (Gomes et al., 2016).

In addition, in areas where the Biomphalaria population has been reduced, persistent transmission may occur due to favorable environmental conditions and the adaptation of some parasites to changes. Controlling actions and monitoring of local environmental conditions, such as water quality and basic sanitation, play crucial roles in preventing the transmission cycle from resuming. These environmental conditions are often mentioned as variables that facilitate or hinder the transmission of parasitic disease.

Finally, it is important to highlight that, while direct transmission via other intermediate hosts is not known in schistosomiasis, there is a continuous need for monitoring to detect possible adaptations, as well as educational efforts to inform populations about prevention, especially in risk areas.

According to Moura et al. (2020), data collected by SINAN indicate that many cases registered in Southeast may be imported because of temporary migrations and travel between regions. These data suggest that, despite the absence of active foci of Biomphalaria in some areas of Southeast, the flow of people from endemic regions results in new local diagnoses of schistosomiasis, which are reported regionally.

In 2010, the Northeast Region had the highest percentage of *Biomphalaria glabrata* captured, with a total of 8,526 snails, 147 of which tested positive for the disease, and a total of 47,459 snails of the species *Biomphalaria straminea*, 2 of which tested positive. In 2010, 504 *Biomphalaria tenagophila* snails were found in the Southeast Region, with 504 tests positive for schistosomiasis. In the southern region, there are no data for the period studied. In addition to the Northeast Region, the other regions also presented a reduction in the number of mollusks captured. This finding may indicate the absence of positive cases, as there are no infected mollusks to transmit the disease.

The prevalence of schistosomiasis varies in different regions of Brazil due to socioeconomic and environmental factors. In areas with poor sanitation, such as Northeast, the disease is more common, as the conditions favor the transmission of the parasite. However, it is essential to maintain control programs and facilitate access to treatment throughout the country, thus reducing the impact of schistosomiasis on public health. An epidemiological analysis revealed the significant prevalence of schistosomiasis in several regions of Brazil, especially Northeast Brazil, corroborating information from Barreto and Lobo (2021), who described the distribution of cases of this endemic disease from 2010--2017.

Despite advances in reducing epidemiological indicators, the effectiveness of the schistosomiasis control program (PCE) needs to be reassessed. The stability of the indicators may not fully reflect reality because of the possible underreporting of cases. A more integrated and sustained approach is recommended to improve surveillance, diagnosis, treatment and control strategies for schistosomiasis in Brazil (Silva&Wanderley, 2022).

A study by Cruz et al. (2020) on schistosomiasis in Sergipe revealed a worrying picture, with an increasing trend in cases and a high parasite load between 2008 and 2017. During this period, there was a significant decrease in adherence to the Schistosomiasis Control Program (PCE) and in the number of tests performed, indicating a reduction in the program's actions and a possible underreporting of cases. This scenario contrasts with the broader analysis presented in this research, which addresses epidemiological data between 2010 and 2021, showing that, despite the efforts of the PCE, the Northeast Region and Southeast Region of Brazil still record the highest incidence of cases, reflecting ongoing challenges in the management and control of the disease.

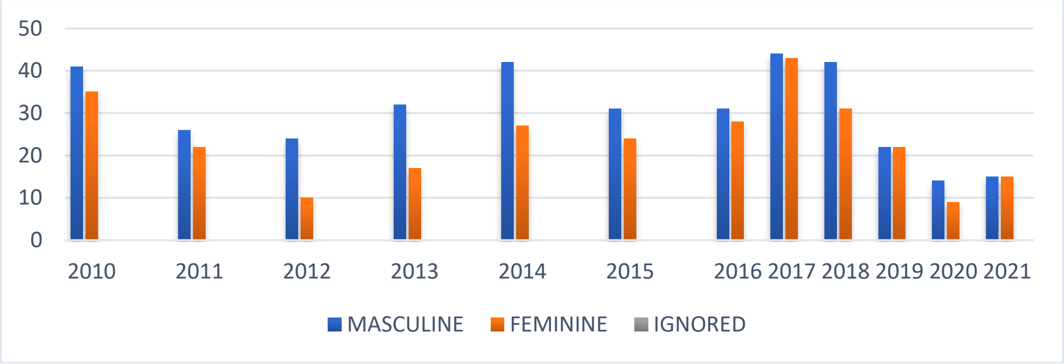
It is important to emphasize, however, that the program faces significant challenges, including the need to maintain and strengthen surveillance and control measures to sustain the objectives achieved. The decrease in operational action after 2007 is a point of concern, as it may compromise the progress made to date. Therefore, developing strategies to overcome these challenges, such as strengthening epidemiological surveillance, developing health education programs and implementing more effective basic sanitation policies, is crucial.

When analyzing data from the Notifiable Diseases Information System (SINAN) on the prevalence of schistosomiasis, it is possible to observe significant variations on the basis of factors such as sex, age range, and race. This information is essential for identifying inequalities and guiding public health strategies that more effectively meet the needs of different population groups.

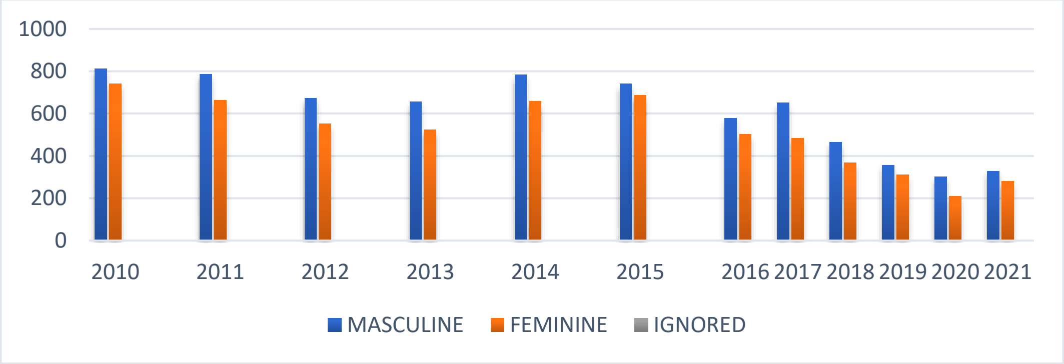
The prevalence of schistosomiasis is greater among males (Graph 13, 14, 15, 16, 17). As highlighted by Costa e Silva Filho (2021), this prevalence is largely because men often engage in activities such as fishing and agricultural work, which increases their contact with contaminated water. In addition, they tend to adopt risky behaviors, such as swimming in rivers and lakes without proper precautions, and seek medical care less frequently, which can lead to late diagnoses.

This pattern suggests the need for further investigation into the reasons behind this gender disparity, including biological, behavioral, and socioeconomic factors that may contribute to men's greater vulnerability to schistosomiasis. This information is critical for developing prevention and treatment strategies that consider sex differences.

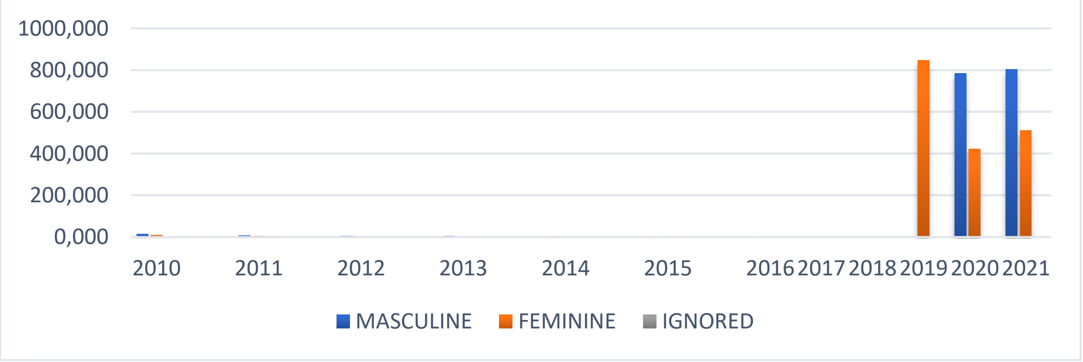
Graph 13. Analysis of the prevalence of schistosomiasis by sex in the northern region of Brazil (2010--2021).



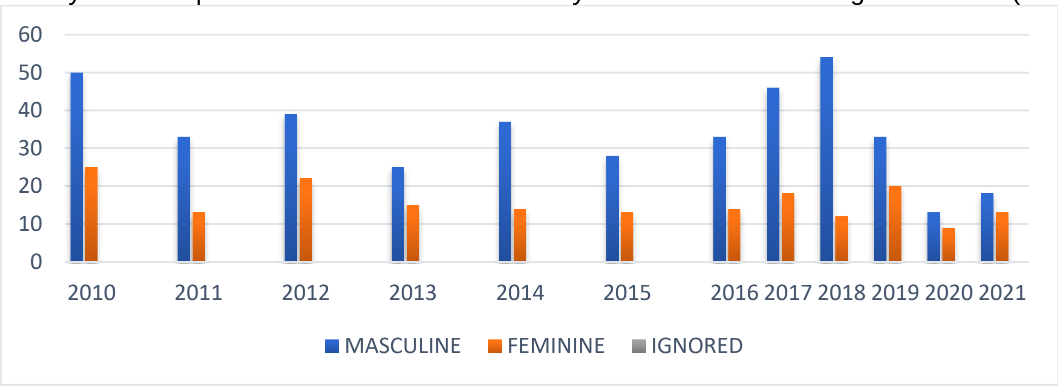
Graph 14. Analysis of the prevalence of schistosomiasis by sex in the Northeast Region of Brazil (2010--2021).



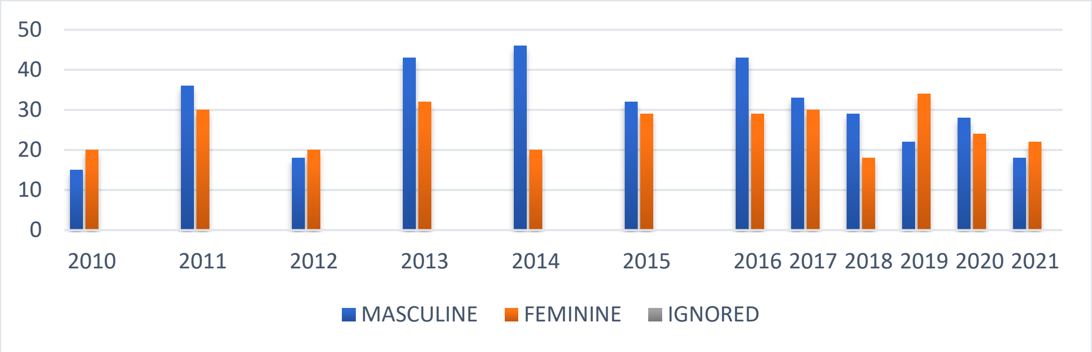
Graph 15. Analysis of the prevalence of schistosomiasis by sex in the Southeast Region of Brazil (2010--2021).



Graph 16. Analysis of the prevalence of schistosomiasis by sex in the southern region of Brazil (2010--2021).



Graph 17. Analysis of the Prevalence of Schistosomiasis by Sex in the Midwest Region of Brazil (2010--2021).

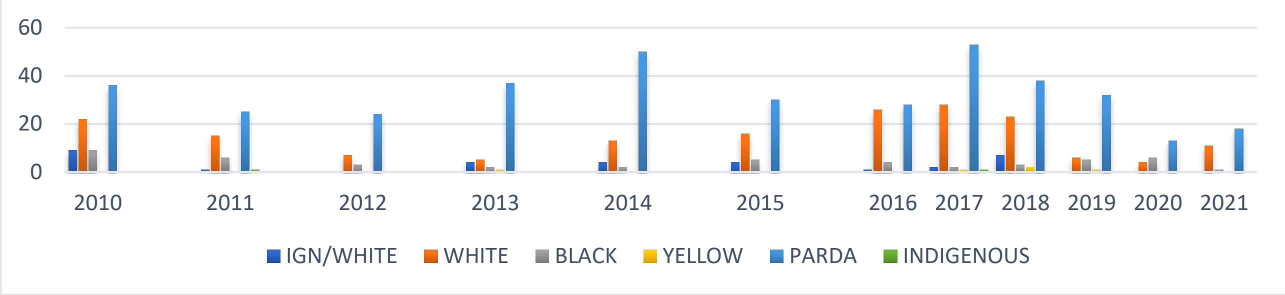


According to the data obtained, the disease was predominantly found among people of mixed race in the North, Northeast, Southeast and Midwest Regions. Mixed race populations often face challenges related to poverty, such as limited access to health services, basic sanitation and inadequate housing, which increases their vulnerability to schistosomiasis. In contrast, in the southern region, the prevalence was greater among white people (Graph 18, 19, 20, 21, 22).

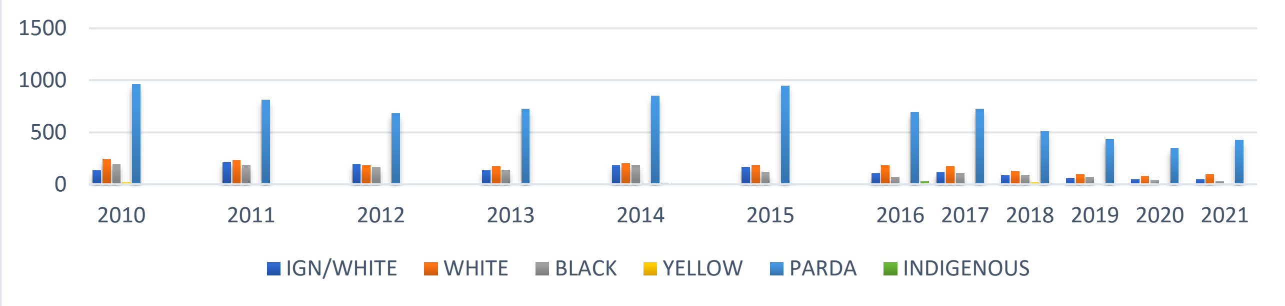
With respect to the South region, there is a certain discrepancy between the data from the Notifiable Diseases Information System (SINAN) and the Schistosomiasis Control Program (PCE), concerning positive cases. As previously described, according to the Schistosomiasis Control Program (PCE), data collected for positive cases of schistosomiasis were collected up to 2011. However, when we consulted the Notifiable Diseases Information System (SINAN), cases in 2021 referred to the gender variable, which resulted in failure in the communication of the systems, making it difficult to accurately understand the epidemiology of schistosomiasis. While SINAN focuses on reporting cases of various diseases and its data are subject to review, the PCE focuses on specific control actions, resulting in data that may not reflect the reality of the disease in certain regions. This lack of alignment prevents the formulation of effective public health policies and the implementation of appropriate interventions.

These data suggest significant regional variation in the distribution of disease, which may indicate the influence of socioeconomic, environmental, or genetic factors specific to each region (Andrade et al., 2022).

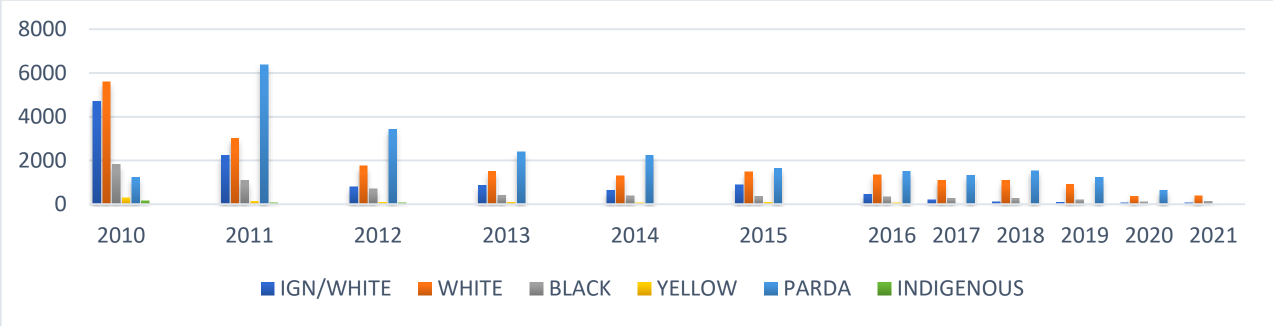
Graph 18. Analysis of the prevalence of schistosomiasis by race in the northern region of Brazil (2010-2021).



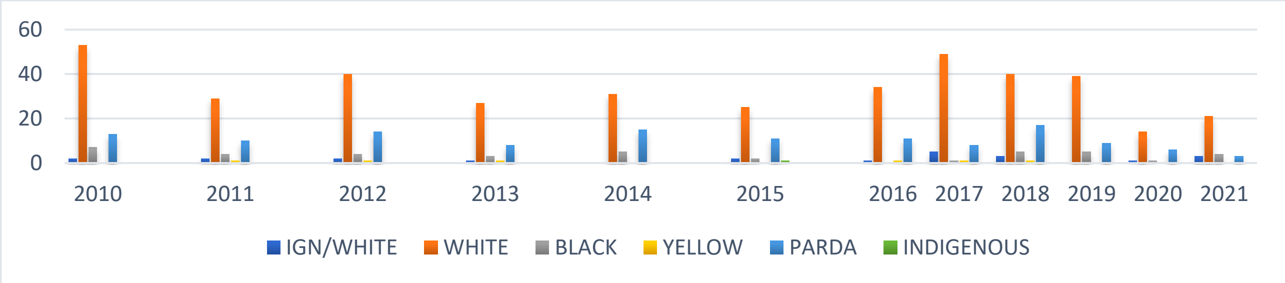
Graph 19. Analysis of the prevalence of schistosomiasis by race in the Northeast Region of Brazil (2010--2021).



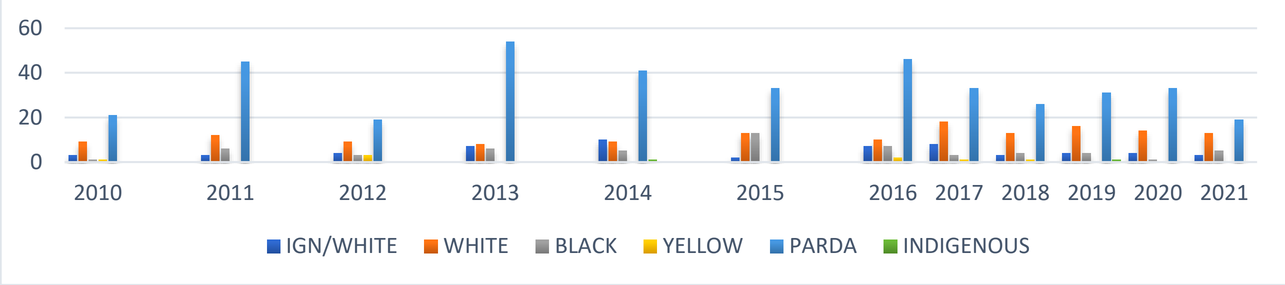
Graph 20. Analysis of the prevalence of schistosomiasis by race in the Southeast Region of Brazil (2010--2021).



Graph 21. Analysis of the prevalence of schistosomiasis by race in the southern region of Brazil (2010--2021).



Graph 22. Analysis of the Prevalence of Schistosomiasis by Race in the Midwest Region of Brazil (2010--2021).



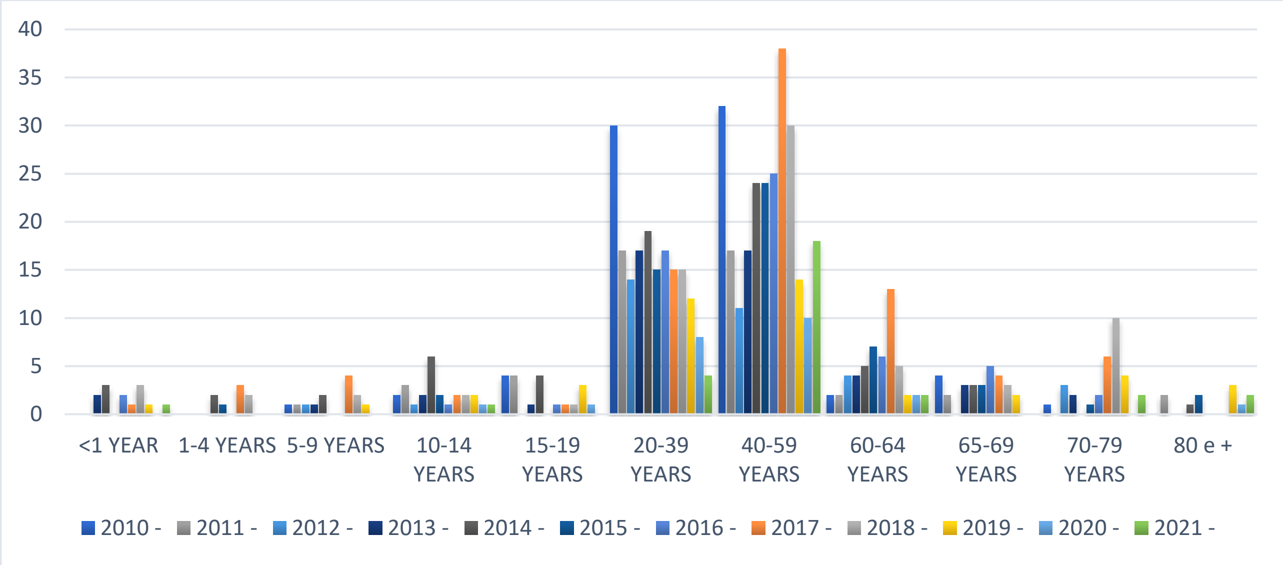
The age range of schistosomiasis patients presents significant regional differences. In the North Region, the predominant range is 40-59 years old, suggesting a concentration of cases in a more mature age group. This situation may be related to greater accumulated exposure to the parasite throughout life, especially in rural areas, where the population frequently interacts with contaminated bodies of water (Graph 23, 24, 25, 26, 27).

In Northeast, the age distribution has changed over time. Until 2015, the predominant range was 20--39 years of age, but between 2015 and 2021, there was a transition to the 40--59 years of age. This change may indicate an evolution in the demographics of cases or changes in risk factors over the years, resulting in an increase in incidence among older people.

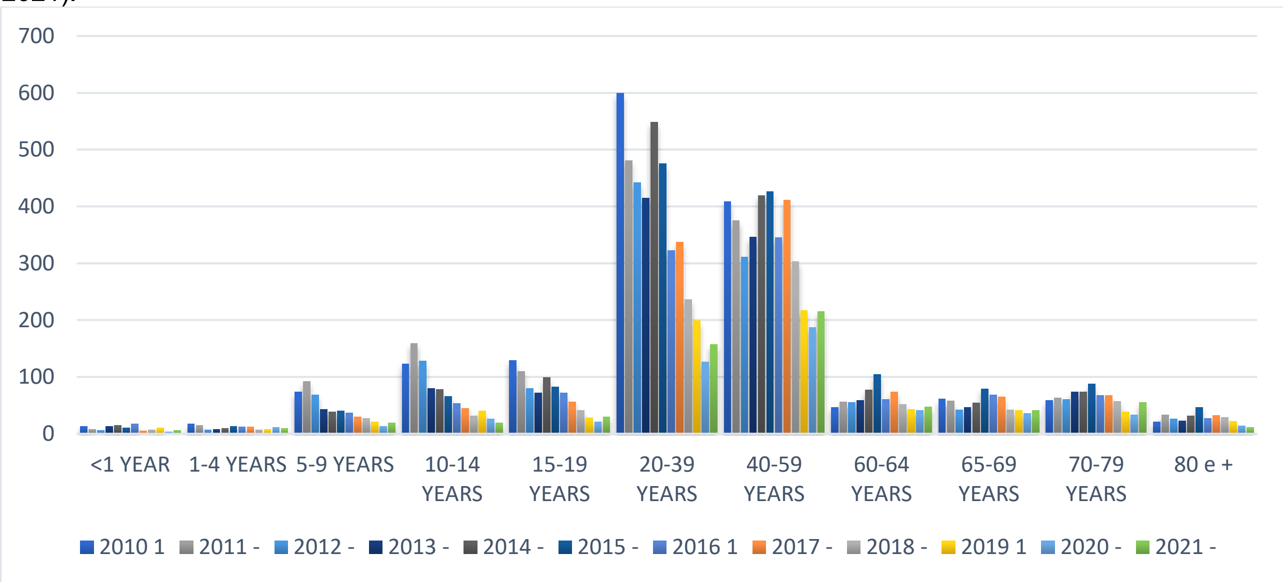
In the Southeast, South and Central-West Regions, the most affected age group is 20--39 years, which suggests that young adults are more exposed to activities that favor infection, such as agricultural work, the use of contaminated water and recreational practices in affected areas (Costa e Silva Filho, 2021).

Furthermore, the detection and treatment of schistosomiasis may be more common among younger people in some regions, whereas older adults may not seek medical care until the disease becomes more severe. The relationship between socioeconomic conditions and health also influences the prevalence of schistosomiasis, as factors such as education, access to information and health services vary between regions and age groups.

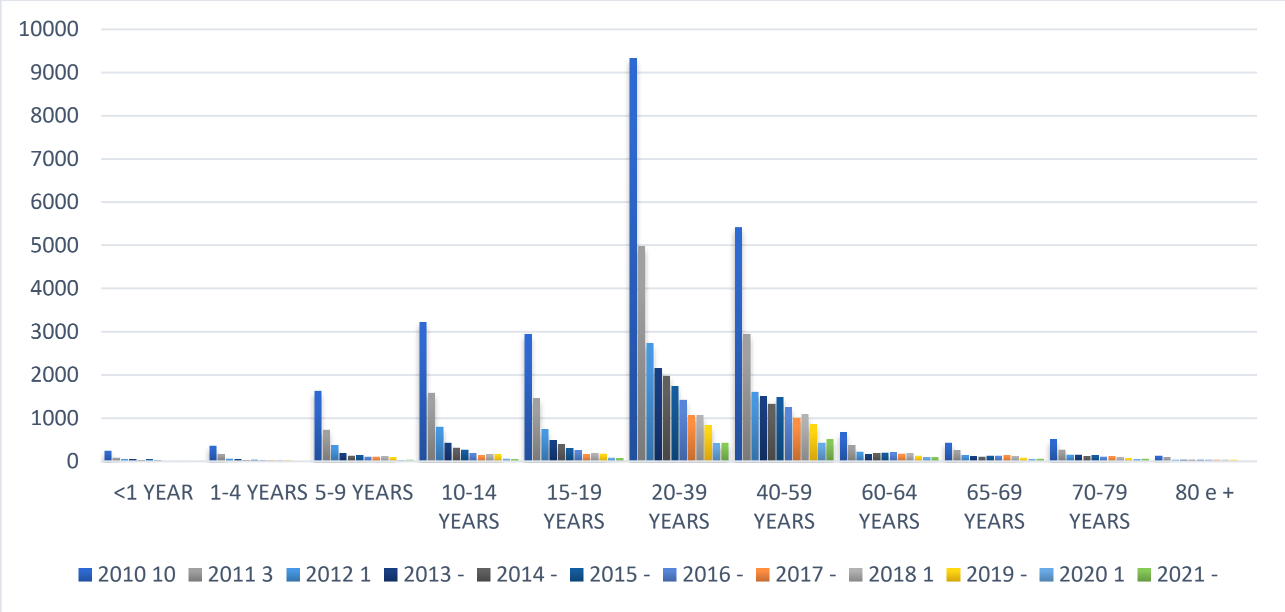
Graph 23. Analysis of the Prevalence of Schistosomiasis by Age Group in the Northern Region of Brazil (2010--2021).



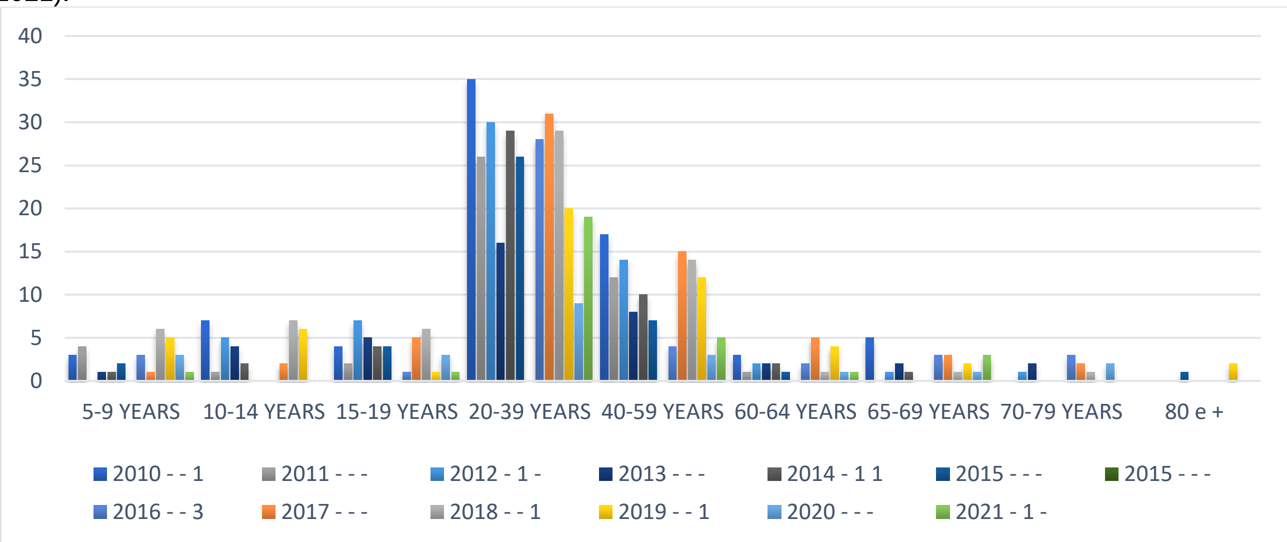
Graph 24. Analysis of the Prevalence of Schistosomiasis by Age Group in the Northeast Region of Brazil (2010--2021).



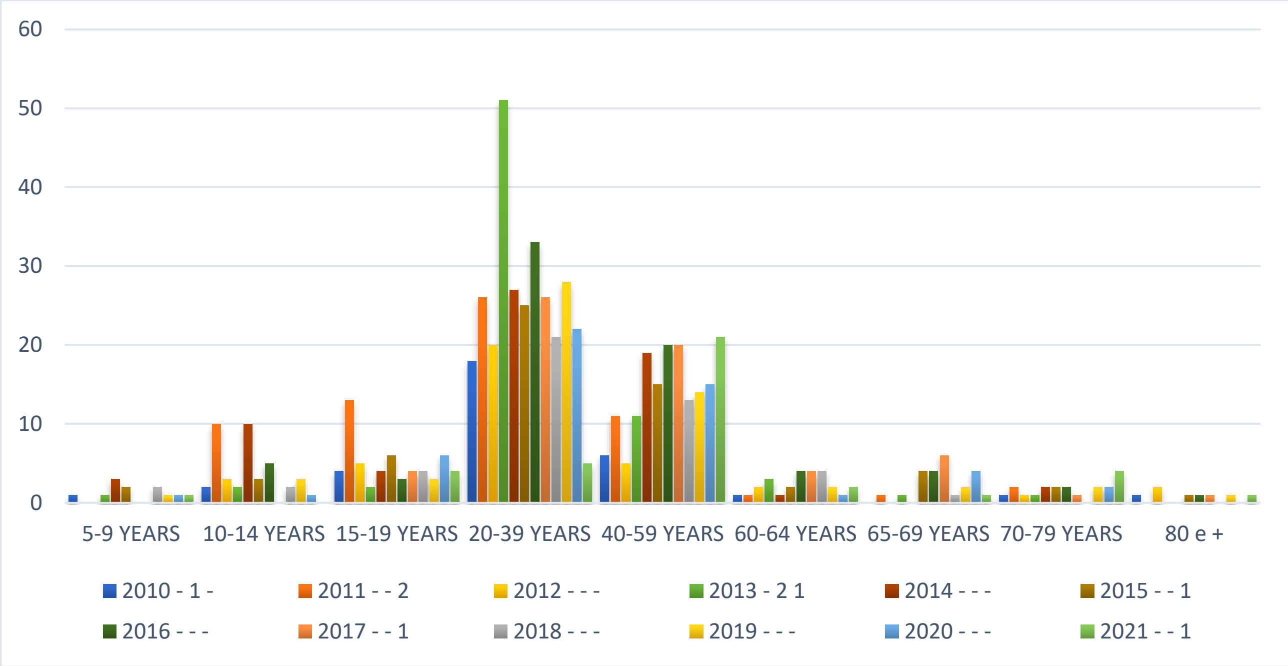
Graph 25. Analysis of the Prevalence of Schistosomiasis by Age Group in the Southeast Region of Brazil (2010--2021).



Graph 26. Analysis of the Prevalence of Schistosomiasis by Age Group in the South Region of Brazil (2010--2021).



Graph 27. Analysis of the Prevalence of Schistosomiasis by Age Group in the Midwest Region of Brazil (2010--2021).



In 2010 and 2013, the regions with the highest prevalence of reported cases of schistosomiasis were Northeast, with more than one million and five hundred thousand cases, respectively, and Southeast, which recorded approximately 948 thousand cases. The high prevalence in Northeast is directly related to the contact of the population with water contaminated by the larvae of the parasite Schistosoma, which develops in snails in aquatic environments. Many of these affected areas are rural or located near urban centers, where the population uses rivers and lakes for leisure and hygiene activities, thus facilitating the transmission of the disease. Although the Southeast Region is more developed than other parts of Brazil are, there are still areas with poor sanitation conditions that favor the spread of the disease. The presence of rural areas on the outskirts of large cities, where people can access contaminated bodies of water, also contributes to the spread of schistosomiasis. Furthermore, the migration of individuals from endemic regions to Southeast in search of better living conditions may have introduced the disease into areas where the prevalence was historically low.

Agricultural activities that depend on water from rivers and lakes increase the risk of infection, especially in regions with snail hosts. Finally, social inequality can affect access to health information and medical services, resulting in late diagnosis and higher case reporting.

Between 2010 and 2017, Brazil recorded a worrying trend in cases, with specific regions of the country, such as Northeast, being the most affected. The variations in the numbers reflect not only environmental conditions but also social inequalities that influence the population's exposure to the disease. Inadequate control of water sources and lack of basic sanitation are key factors that contribute to the persistence of the disease. According to a study on the epidemiological profile of schistosomiasis in Brazil between 2010 and 2017, the data highlight the importance of regional monitoring to understand the concentration of cases and direct appropriate control actions (SILVA et al., 2019).

The period analyzed reveals that, despite surveillance and control efforts, schistosomiasis continues to be a public health challenge. The distribution of cases often follows geographic patterns related to the presence of rivers and flood areas, where snails proliferate. Furthermore, there is a significant impact on health systems due to the chronicity of the disease and its complications, which can include hepatomegaly and liver fibrosis in advanced stages.

The data collected by the SINAN described above indicate that men were the most affected by schistosomiasis during the period analyzed. This pattern may be associated with occupational activities typically carried out by men in rural and peri-urban areas, such as agriculture and fishing, which involve greater contact with contaminated bodies of water. Although there is a male predominance, it is essential that public health policies consider both sexes, considering their different forms of exposure to the disease.

The age group also significantly varied in terms of the prevalence of cases. This study revealed that most of the reported cases involved children and young adults, especially those in the 5–14 years age group, who tend to have more contact with contaminated aquatic environments. This group is considered more vulnerable since the infection can compromise long-term development. In adults, the 20--39 age group also presented high rates, indicating that work activities in rural areas continue to be a significant risk factor.

With respect to the race/color variable, schistosomiasis disproportionately affects individuals who self-identify as black or brown. This reflects the socioeconomic disparities in Brazil, since these populations often live in areas with inadequate infrastructure and without adequate access to basic sanitation. These studies reinforce that these groups face greater exposure to the disease and have less access to preventive care and treatment, which exacerbates health inequalities.

Therefore, it is essential to consider these variables when developing more effective and fair control strategies that recognize the differences in exposure and vulnerability to schistosomiasis among different population groups.

CONCLUSION

It can be concluded that the prevalence of schistosomiasis varies significantly among the different regions of Brazil and is influenced by a series of socioeconomic, environmental and structural factors. The North and South regions have been less affected by the disease and show a tendency to continue without reported cases. In contrast, the Southeast and Northeast have recorded increasingly lower numbers of infections.

The mollusks that transmit schistosomiasis are not found in the North or South Region, and their presence in Southeast is decreasing. In Northeast, although the population of transmitting snails has decreased, it remains stable, which may explain the persistence of positive cases in the region.

In terms of race, sex and age, schistosomiasis shows distinct patterns. Individuals of mixed races are more affected in several regions, whereas in South, the prevalence is higher among whites, reflecting socioeconomic inequalities. Men have a relatively high infection rate, possibly due to work activities that expose them to contact contaminated water.

In terms of age, the disease is more common among adults aged 40--59 years in North and among young people aged 20--39 years in Southeast, South and Central, which may be related to the activities performed by these groups. In Northeast, there is a change in the age parameter, with an increase in cases among older people.

The most affected regions, especially Northeast, face challenges related to contaminated water and inadequate sanitation conditions. Even in Southeast, which is more advanced in development, there are still vulnerable areas. Therefore, it is crucial to implement public health strategies that consider these regional and demographic differences, aiming to combat schistosomiasis effectively and sustainably.

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