IMPACTO CIENTÍFICO EDITORA

EPIDEMIOLOGICAL PROFILE ANALYSIS OF MORTALITY DUE TO SCHISTOSOMIASIS IN THE STATE OF ALAGOAS BETWEEN 2019 AND 2023

ANÁLISE DO PERFIL EPIDEMIOLÓGICO DA MORTALIDADE POR ESQUISTOSSOMOSE NO ESTADO DE ALAGOAS ENTRE 2019 E 2023

ANÁLISIS DEL PERFIL EPIDEMIOLÓGICO DE LA MORTALIDAD POR ESQUISTOSOMIASIS EN EL ESTADO DE ALAGOAS ENTRE 2019 Y 2023

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ABSTRACT

Considering schistosomiasis as a serious public health problem, especially in the state of Alagoas, where socioeconomic and environmental factors favor its persistence, this study aims to analyze the epidemiological profile of mortality due to this disease between the years 2019 and 2023. The objective is to understand the distribution of deaths according to sociodemoFigureic variables such as sex, age group, color/race, and education level, in order to support prevention and control policies. To this end, an epidemiological, descriptive, and quantitative study was conducted, using secondary data obtained from the Mortality Information System (SIM/DATASUS). The data were organized in spreadsheets and analyzed through absolute and relative frequencies. Thus, it was observed that there were 215 deaths during the analyzed period, with a higher concentration among brown-skinned individuals, those with low education levels, and older ages, with 2022 being the most critical year in terms of number of deaths. This allows concluding that schistosomiasis mortality in Alagoas is strongly associated with social inequality and the vulnerability of specific populations, requiring integrated interventions involving epidemiological surveillance, basic sanitation, health education, and equitable access to health services.

Keywords: Schistosomiasis. Mortality. Alagoas.

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RESUMO

Considerando a esquistossomose como um grave problema de saúde pública, especialmente no estado de Alagoas, onde fatores socioeconômicos e ambientais favorecem sua persistência, este estudo visa analisar o perfil epidemiológico da mortalidade por essa doença entre os anos de 2019 e 2023. Objetiva-se compreender a distribuição dos óbitos segundo variáveis sociodemográficas como sexo, faixa etária, cor/raça e escolaridade, a fim de subsidiar políticas de prevenção e controle. Para tanto, procede-se à realização de uma pesquisa epidemiológica, descritiva e quantitativa, utilizando dados secundários obtidos do Sistema de Informação sobre Mortalidade (SIM/DATASUS). Os dados foram organizados em planilhas e analisados por meio de frequências absolutas e relativas. Desse modo, observa-se que houve 215 óbitos no período analisado, com maior concentração entre indivíduos pardos, de baixa escolaridade e com idades mais avançadas, sendo o ano de 2022 o mais crítico em número de mortes. O que permite concluir que a mortalidade por esquistossomose em Alagoas está fortemente associada à desigualdade social e à vulnerabilidade de populações específicas, exigindo intervenções integradas que envolvam vigilância epidemiológica, saneamento básico, educação em saúde e acesso equitativo aos serviços de saúde.

Palavras-chave: Esquistossomose. Mortalidade. Alagoas.

RESUMEN

Considerando la esquistosomiasis como un grave problema de salud pública, especialmente en el estado de Alagoas, donde factores socioeconómicos y ambientales favorecen su persistencia, este estudio tiene como objetivo analizar el perfil epidemiológico de la mortalidad por esta enfermedad entre los años 2019 y 2023. Se pretende comprender la distribución de los fallecimientos según variables sociodemográficas como sexo, grupo etario, color/raza y nivel educativo, con el fin de apoyar políticas de prevención y control. Para ello, se realizó una investigación epidemiológica, descriptiva y cuantitativa, utilizando datos secundarios obtenidos del Sistema de Información sobre Mortalidad (SIM/DATASUS). Los datos fueron organizados en hojas de cálculo y analizados mediante frecuencias absolutas y relativas. Así, se observó que hubo 215 fallecimientos en el período analizado, con mayor concentración entre individuos pardos, con bajo nivel educativo y edades avanzadas, siendo el año 2022 el más crítico en número de muertes. Esto permite concluir que la mortalidad por esquistosomiasis en Alagoas está fuertemente asociada a la desigualdad social y a la vulnerabilidad de poblaciones específicas, requiriendo intervenciones integradas que involucren vigilancia epidemiológica, saneamiento básico, educación en salud y acceso equitativo a los servicios de salud.

Palabras clave: Esquistosomiasis. Mortalidad. Alagoas.

1 INTRODUCTION

Parasitic diseases are widely recognized as a serious public health problem, affecting millions of people globally. Among these diseases, schistosomiasis, a parasitosis caused by worms of the species *Schistosoma mansoni*, stands out, occupying the second place among the most prevalent infectious-parasitic diseases in the world, affecting about 240 million individuals in 76 countries and, according to the WHO, causing more than 200,000 deaths in 2012 (WHO, 2014). In Brazil, schistosomiasis continues to be a public health problem, in which it is estimated that seven to eight million people are infected. Between 2010 and 2022, 93,521 cases of schistosomiasis and 5,495 deaths due to complications of this infection were reported in bulletins made available by the Notifiable Diseases Information System (SINAN) and the Mortality Information System (SIM) (Oliveira *et al.*, 2023).

Most of the time, the occurrence of cases is related to leisure or work activities, as well as practices that allow contact with contaminated water, especially where domestic sewage is dumped (Brito, 2023). The Southeast and Northeast regions are the most impacted, with the northeastern states having the highest prevalence rates. Alagoas, a state located in the Northeast, presents ideal conditions for the occurrence of schistosomiasis due to environmental factors, the presence of transmitting mollusks, marked social inequality, and frequent human contact with bodies of water (Souza, 2021). The state is considered an endemic region for schistosomiasis, due to the high prevalence and mortality of the disease throughout its territory, being the third state with the highest incidence of infection by *Schistosoma mansoni* in the Northeast, the champion region in number of deaths from the disease in Brazil (Gomes, 2016). This high transmission is facilitated by certain characteristics of the state, in addition to the economic activities of the region, which often involve contact with water, are a determining factor in the spread of the disease (Gomes *et al.*, 2018).

This disease can manifest itself in various ways, from asymptomatic cases to severe forms, whose intensity varies according to the phase of the disease, which can be initial (acute) or advanced (chronic). In the acute phase of schistosomiasis, the liver and spleen may increase in size, while the rectum and sigmoid have edema, redness, hemorrhages, and small ulcers (Santos *et al.,* 2023). The main damage is granulomatous vasculitis, with granulomas predominating in the intestines and liver. In the intestines, the mucosa irritated by the eggs causes edema and hemorrhages, and in the liver necrosis and infiltration of inflammatory cells occurs. Changes in the spleen and necrotizing arteritis in the lungs may also occur (Salas-corona, J. *et al., 2022)*element. In the chronic phase, eggs, granulomas, and cell infiltrations are mainly concentrated in the intestines and liver, but they can also affect

other organs, such as the lungs, heart, and nervous system, to a lesser extent. The presence of fibrosis and vascular lesions can be mild, but in some cases, these lesions worsen, resulting in severe forms of the disease, which can occur even with smaller lesions in critical areas (Veroseni, 2020).

The Brazilian Schistosomiasis Program (PCE), created in 1976 under the name of the Special Schistosomiasis Control Program, aimed to reduce the number of cases and transmission of the disease by 4% (Silva *et al.*, 2022). Although it did not initially achieve its goal, over the years it changed the epidemiological pattern of the disease in the country with the implementation of continued disease management actions, by reducing the number of cases in the states of Bahia and Minas Gerais, previously the most prevalent (Cruz, 2020). However, currently, the disease is still a challenge to be faced due to its high prevalence and rate of severe cases with mortality mainly in the southeast and northeast (Cardoso *et al.*, 2024).

In view of the importance of this disease throughout Brazil, especially in Alagoas, this article aims to deepen the epidemiological analysis of schistosomiasis, examining its mortality rate as well as analyzing the variables that interfere in the indices found and the sociodemoFigureic factors that contribute to the transmission of the disease in question.

2 THEORETICAL FRAMEWORK

The theoretical framework in a study comprises a critical and organized analysis of the literature pertinent to the theme, providing a theoretical contextualization and defining the key concepts. It should comprehensively contain previous theories, models, and research, identifying gaps, contradictions, and consensuses in the literature that are important to the focus of the work being developed.

3 METHODOLOGY

This research is of an epidemiological, descriptive and quantitative nature, with a cross-sectional approach. To carry it out, data from the Mortality Information System (SIM), available at the Department of Informatics of the Unified Health System (DATASUS), were used.

Mortality, epidemiological and sociodemoFigureic data were collected following the following steps: 1) access to the DATASUS platform; 2) selection of the option "Health Information (TABNET)"; 3) choose "Vital Statistics"; 4) "Mortality – since 1996, according to ICD-10" option selected "General mortality"; 6) selection of the State of Alagoas; 7) finally,

the cause of death (028 - Schistosomiasis) was chosen, associated with the variables of sex, age group, race/color and education. The analysis period considered the years 2019 to 2023.

The variables included in this study were chosen based on the associations suggested by reference studies on the subject, as well as the availability of information in the SIM/DATASUS database.

This study used the Tenth Revision of the International Classification of Diseases (ICD-10), available on the DATASUS website, to access information on schistosomiasis mortality. Cases of deaths from schistosomiasis reported in SIM/DATASUS in the State of Alagoas, between 2019 and 2023, according to ICD-10, were included. Deaths in which schistosomiasis was associated with other pathologies were excluded from the analysis.

The following indicators were calculated: 1) annual schistosomiasis mortality coefficient (number of deaths due to schistosomiasis in a given year, divided by the total estimated population of the same year, multiplied by 10 thousand); 2) annual schistosomiasis mortality coefficient according to sex (number of deaths due to schistosomiasis in a specific year, segmented by sex, divided by the total population of that sex in the same year, multiplied by 10 thousand); 3) annual schistosomiasis mortality coefficient by age group (number of deaths due to schistosomiasis in a specific age group, in a given year, divided by the total population of that age group in the same year, multiplied by 10 thousand). The coefficients related to race and schooling were not calculated due to the unavailability of data on the number of deaths from schistosomiasis of the aforementioned indicators, as well as the total population corresponding to each of these indicators in the years analyzed.

To estimate the population by sex and age group per year, preliminary population estimates made available by the Brazilian Institute of GeoFigurey and Statistics (IBGE) were used.

After data collection, a database organized in spreadsheets was created in Microsoft Excel version 2016 software. From this database, the information was analyzed in terms of absolute frequencies (absolute numbers) and relative frequencies (percentages, ratios and rates). For a clearer and more systematized presentation, Figures and tables were developed.

As it is a research based on secondary data in the public domain, the information analyzed does not contain the identification of the individuals, thus ensuring complete anonymity. Therefore, it was not necessary to prepare the Informed Consent Form (ICF), nor to submit it to the evaluation of the Research Ethics Committee (REC).

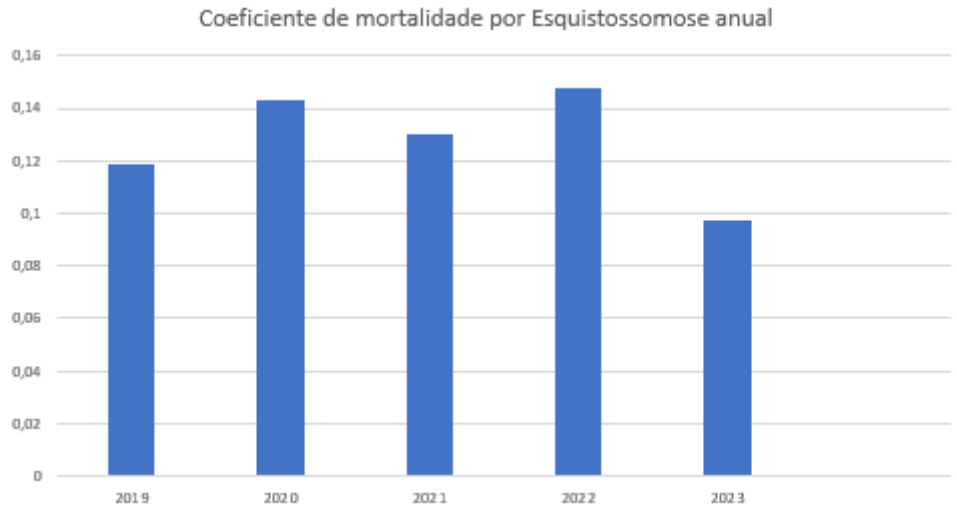
4 RESULTS AND DISCUSSIONS

In Brazil, schistosomiasis is an endemic disease of great importance for public health. The Northeast Region concentrates most of the deaths, representing 64.7% of the total cases in the country. Among the states in this region, Pernambuco leads with 48.5% of deaths, followed by Bahia, with 20.3%, and Alagoas, with 15.5%. These areas are often affected by seasonal flooding, which favors the accumulation of waste, contributing to the spread of effluents and the proliferation of disease vectors (Santos, Heller, 2023).

Absolute mortality from schistosomiasis in the State of Alagoas recorded 215 deaths between 2019 and 2023. When examining the distribution of deaths over the five years studied, an upward trend was observed from 2019 to 2022, followed by a decrease in 2023. Data referring to the average mortality coefficient due to schistosomiasis during the analyzed period, for every 10 thousand inhabitants, according to the year of death, indicate that 2022 had the highest death rate, with a coefficient of 0.148. The year 2020 continues with a coefficient of 0.143, while 2021 occupies the third position with a coefficient of 0.130. The year 2023 recorded the lowest mortality coefficient, with 0.097 (Figure 1).

Figure 1

Schistosomiasis mortality coefficients, per year, in Alagoas, from 2019 to 2023 (deaths per 10 thousand inhabitants)



Source: Prepared by the authors.

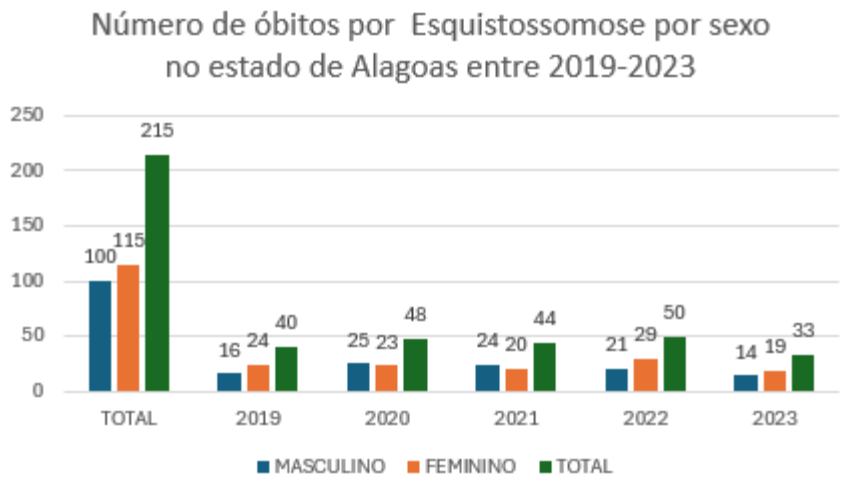
As illustrated in Figure 2, the year 2022 recorded the highest number of deaths from schistosomiasis, totaling 50 cases. On the other hand, the lowest number of deaths occurred in 2023, with 33 records. In the last five years, most of the deaths due to schistosomiasis in Alagoas occurred among females, totaling 115 cases, which represents 53.4% of the total. In comparison, among males, 100 deaths were recorded, corresponding to 46.5% of the cases.

In addition, in 2022, the highest number of deaths among women was recorded, totaling 29 cases (25.2%), while 2023 had the lowest number, with 19 female deaths (16.5%). On the other hand, in 2020, the number of male deaths was higher, reaching 25 cases (25%), and in 2023, there was the lowest rate among men, with 14 records (14%).

Regarding the sociodemoFigureic characteristics of schistosomiasis mortality in Alagoas, although a slight predominance of deaths was observed among women (115 cases) compared to men (100 cases), this difference is considered small. This data raises important questions about the relationship between gender and susceptibility to the disease, suggesting that, in the local context, schistosomiasis does not have a clear predilection for sex (Friani *et al.*, 2022).

Figure 2

Representation of the epidemiological profile of schistosomiasis deaths in Alagoas, by sex, from 2019 to 2023

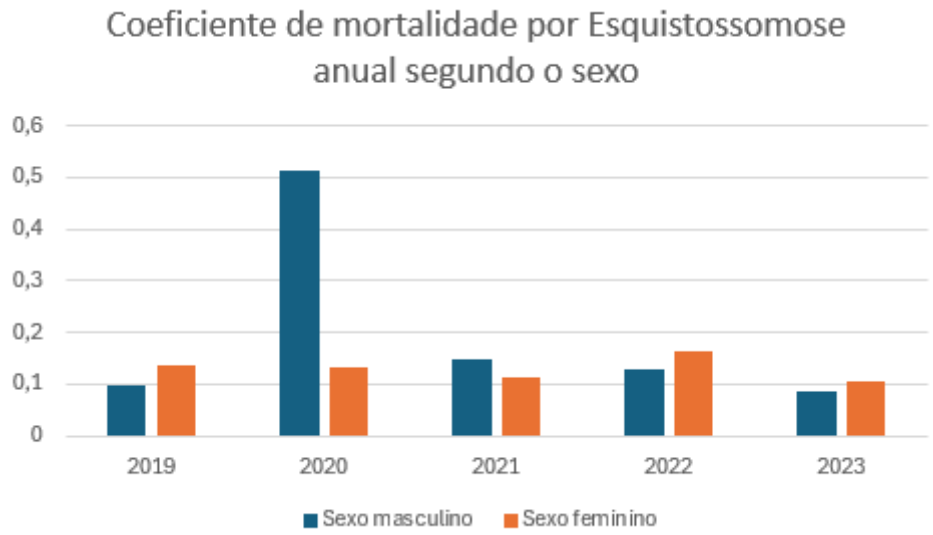


Source: Prepared by the authors.

According to Figure 3, the data on the schistosomiasis mortality coefficient, classified by sex during the analyzed period, for every 10 thousand inhabitants, show that the highest coefficient for the male population was recorded in 2020, with a value of 0.155. For the female population, the highest coefficient occurred in 2022, reaching 0.164. In contrast, the lowest coefficients were observed in 2023, with 0.086 for the male population and 0.107 for the female population.

Figure 3

Schistosomiasis mortality coefficients, by sex, in Alagoas, from 2019 to 2023 (deaths per 10 thousand inhabitants)

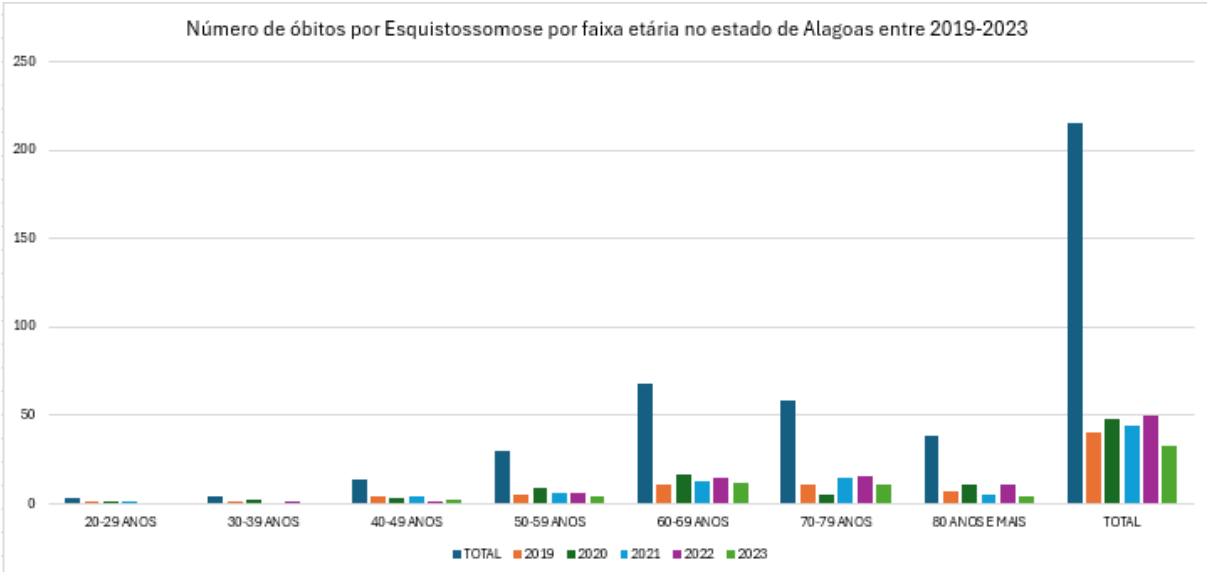


Source: Prepared by the authors.

In compliance with the presentation of the data in Figure 4, when aggregating the data from the years 2019 to 2023, it was found that most deaths by age group, corresponding to 31.6%, occur among individuals aged 60 to 69 years. The second highest rate was observed between 70 and 79 years of age, representing 26.9% of the cases. On the other hand, the lowest percentage of deaths, 1.39%, was recorded among those aged 20 to 29 years, followed by the 30 to 39 age group, with 1.86% of deaths. These data suggest that schistosomiasis infection probably began at earlier ages and lasted throughout the life of individuals, affecting several age phases. This trend corroborates studies carried out at the national level that also point to a higher prevalence of deaths in these same age groups (Rocha, *et al*., 2016). Although advanced ages concentrate the highest mortality, the progression of the disease from younger ages points to a possible late diagnosis or inadequate management over the years. These conditions often develop decades after the initial infection, which indicates that schistosomiasis may remain asymptomatic or misdiagnosed for long periods. The increase in lethality, together with the negative correlation between lethality and reported cases, suggests potential underreporting or misdiagnosis, which further aggravates the disease. Another aspect to be considered is the impact of population aging on schistosomiasis control, since older people may have comorbidities that aggravate the evolution of the disease. In addition, this situation may reflect limited access to preventive care and appropriate diagnosis throughout life (Cardoso, 2024).

Figure 4

Representation of the epidemiological profile of schistosomiasis mortality in Alagoas, distributed by age group, from 2019 to 2023

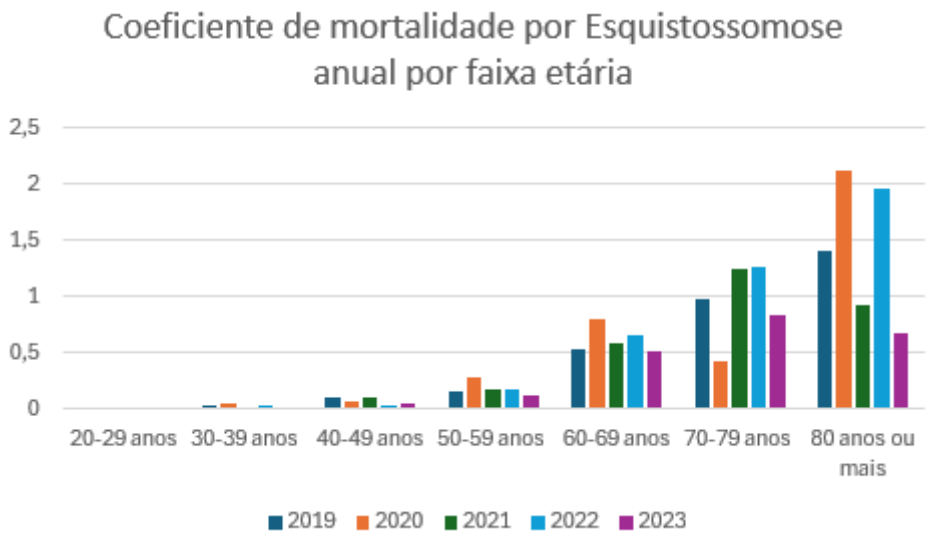


Source: Prepared by the authors.

In accordance with Figure 5, the data on the schistosomiasis mortality coefficient, segmented by age group over the period studied, for every 10 thousand inhabitants, reveal that, in 2019, the age group with the highest coefficient was 80 years or older, with a value of 1.409, while the lowest rate was observed in the 20 to 29 age group, with 0.016. In 2020, the age group with the highest coefficient remained 80 years and over, reaching 2.12, and the lowest rate remained in the 20-29 age group, with 0.016. In 2021, the highest coefficient was recorded in the 70-79 age group, with 1.235, and the lowest rate was again for the 20-29 age group, with 0.016. In 2022, the age group with the highest coefficient was 80 years and over, with 1.962, while the lowest rate was observed in the 20-29 age group, with a coefficient of 0. Finally, in 2023, the highest coefficient was recorded for the age group of 70 to 79 years, with 0.841, and the lowest rates were observed in the groups of 20 to 29 years and 30 to 39 years, both with a coefficient of 0.

Figure 5

Schistosomiasis mortality coefficients, by age group, in Alagoas, from 2019 to 2023 (deaths per 10 thousand inhabitants)

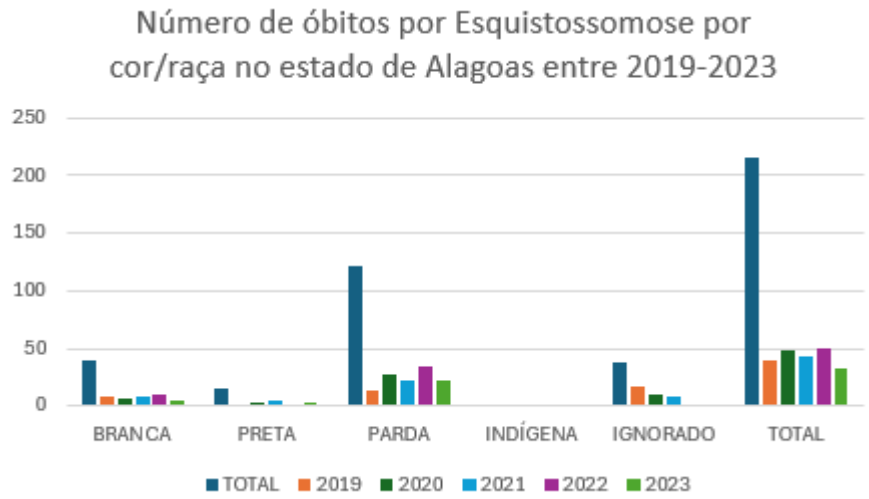


Source: Prepared by the authors.

Most deaths by color/race occurred among people of brown race, representing 56.7% of the cases, while the lowest number was recorded among indigenous people, with 0.46%. The year 2022 stood out for having the highest number of deaths in all races/colors, equivalent to 23.2%, while 2023 had the lowest number of mortality records, meaning 15.3% (Figure 6). This predominance may be related to the fact that brown individuals represent 60.3% of the population of Alagoas, according to data from the IBGE (2022). However, this finding goes beyond a simple demoFigureic issue. This reality points to a broader problem, which involves not only health issues, but also the need for effective public policies aimed at equity in access to essential services. The high mortality among browns in Alagoas may reflect failures in the health system, in the prevention and treatment of the disease, disproportionately affecting groups that already face historical barriers in various areas. Therefore, the relationship between race/color and mortality should not be seen only from a population perspective, but as an indication of the social inequalities that persist and aggravate the vulnerability of these groups in the face of endemic diseases (Dutra, 2024).

Figure 6

Representation of the epidemiological profile of schistosomiasis mortality in Alagoas, distributed by color/race, from 2019 to 2023



Source: Prepared by the authors.

As shown in Figure 7, the highest number of deaths by level of education was observed among the population with unknown data, representing 44.6% of the cases, followed by the group without any education, corresponding to 28.3%. On the other hand, the lowest proportion was found among individuals with 12 or more years of schooling, totaling 3.72%.

Figure 7

Representation of the epidemiological profile of schistosomiasis mortality in Alagoas, distributed by schooling, from 2019 to 2023

Source: Prepared by the authors.

The analysis of data on schooling indicated that the number of records classified as "unknown" reached 96 people, while the second largest category was that of individuals with no schooling, with 61 cases. It is worth noting that the relationship between low level of education, unemployment and poverty plays a crucial role in the spread of schistosomiasis, significantly increasing the risk of mortality from the disease. This situation reveals a worrying scenario, in which the lack of access to education directly contributes to vulnerability to schistosomiasis. The absence of basic education limits access to information on prevention measures, such as hygiene practices and the use of treated water, aggravating exposure to the parasite. In addition, unemployment and poverty, often associated with low educational levels, make these populations more susceptible to living in areas without adequate basic sanitation infrastructure, which facilitates the transmission of the disease. (Cardoso *et al.*, 2024). These factors reflect structural inequalities that not only condition the onset of schistosomiasis, but also perpetuate the cycle of poverty and disease, since individuals in precarious socioeconomic conditions have less access to quality medical care and early diagnosis. Thus, the relationship between schooling and mortality should not be analyzed in isolation, but as part of a broader set of factors that require integrated interventions, aiming not only at eradicating the disease, but also at improving the living conditions of these populations.

It is important to note, however, that studies based on secondary sources, such as the Mortality Information System (SIM), may face limitations due to possible inaccuracies in the data. This situation shows a certain fragility in health information systems, which can lead, among other problems, to the underreporting of cases, negatively impacting epidemiological research. Despite these limitations, the quality of SIM information is still a matter of debate, but it is necessary to recognize the significant expansion of its coverage and reliability in recent years (Girianelli *et al.*, 2018).

5 CONCLUSION

Schistosomiasis continues to be a serious public health problem, especially in states in the northeast region, such as Alagoas, where socioeconomic and environmental conditions favor its dissemination. The data analyzed between 2019 and 2023 reveal a high mortality rate, predominantly among women and in the older age group, indicating a significant relationship between age, gender, and vulnerability to the disease. The predominance of deaths among the brown population and those with low educational level reflects deep social inequalities that need urgent attention. Thus, the importance of constant epidemiological surveillance and the integration of data with public health practices is highlighted, aiming at

reducing cases, complications and, above all, mortality levels. Thus, it is expected that the information presented and discussed here will help in the formulation of prevention policies aimed at the particularities of the local epidemiological scenario.

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