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CHAGAS DISEASE-RELATED MORTALITY TRENDS IN BRAZIL (1996-2021)

TENDÊNCIA DA MORTALIDADE RELACIONADA À DOENÇA DE CHAGAS NO BRASIL (1996-2021)

OLIVEIRA, Vinícius José de[1]
FONSECA, Samantha Luiza Soriano da[2]
VIEIRA, Denilson Silva[3]
SOUSA, Laís de Deus[4]
OLIVEIRA, Bruna dos Santos[5]
CARVALHO, Ana Vitória da Silva[6]
PEREIRA, Eduardo Henrique[7]
BORGES, Fernanda Vianna[8]
PEREIRA, Douglas Alves[9]

1 - PhD in Applied Immunology and Parasitology; Specialist in Zoonosis and Public Health; Coordinator of the Interdisciplinary Research Group on Public Health; Researcher linked to the Research Group Ecoepidemiology of Zoonoses at the (UFU). Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil. Contato do autor principal: dr.vinicius.oliveiras@gmail.com
2 - Veterinary Medicine Undergraduate, member of the Programa de Educação Tutorial (PET) of the Veterinary Medicine course, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.
3 - Veterinarian Physician, Uberlândia, Minas Gerais, Brazil.
4 - Veterinary Medicine Undergraduate, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.
5 - Veterinary Medicine Undergraduate, member of the Programa de Educação Tutorial (PET) of the Veterinary Medicine course, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.
6 - Veterinary Medicine Undergraduate, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.
7 - Veterinarian Physician, Uberlândia, Minas Gerais, Brazil.
8 - Veterinary Medicine Undergraduate, member of the Programa de Educação Tutorial (PET) of the Veterinary Medicine course, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.
9 - Doctoral Student in the Post-graduation Program in Applied Immunology and Parasitology, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil.

ABSTRACT

Introduction: Chagas disease, caused by the parasite *Trypanosoma cruzi*, is a prevalent tropical illness in Latin America. It is transmitted by vector insects and can lead to chronic cardiac and digestive complications, even death. **Objective**: Analyze the sociodemographic characteristics and geographical distribution of Chagas disease-related deaths in Brazil from 1996 to 2021. **Methodology**: This is a descriptive, quantitative, cross-sectional, and epidemiological study. The methodological strategy involved the analysis of epidemiological reports provided by the *Sistema de Informações sobre Mortalidade* (SIM) for the period between 1996 and 2021 in Brazil. **Results/Discussion**: A total of 124,255 deaths were reported, with Minas Gerais, São Paulo, Goiás, and Bahia being the states with the highest prevalence of notifications. Men, whites, married individuals, aged between 60 and 79 years, with a low level of education, are the most affected. 68.73% of the deaths occurred in hospitals. **Conclusions**: Chagas disease remains one of the main

contributors to the decline of public health in Brazil. Implementing control measures and improving access to diagnosis and treatment are of utmost importance to reduce the number of deaths.

KEYWORDS: Brazil; Death records; Epidemiological surveillance; *Trypanosoma cruzi* infection.

RESUMO

Introdução: A doença de Chagas, causada pelo parasito *Trypanosoma cruzi*, é uma doença tropical prevalente na América Latina. É transmitida por insetos vetores e pode levar a complicações crônicas cardíacas e digestivas, até a morte. **Objetivo:** Analisar as características sociodemográficas e a distribuição geográfica das mortes relacionadas à doença de Chagas no Brasil de 1996 a 2021. **Metodologia:** Trata-se de um estudo descritivo, quantitativo, transversal e epidemiológico. A estratégia metodológica envolveu a análise dos boletins epidemiológicos disponibilizados pelo Sistema de Informações sobre Mortalidade (SIM), do período entre 1996 e 2021, ocorridos no Brasil. **Resultados / Discussão:** Foram notificados 124.255 óbitos. Minas Gerais, São Paulo, Goiás e Bahia foram os estados com maior prevalência das notificações. Homens, brancos, casados, com idade entre 60 e 79 anos, com baixo nível de escolaridade são os mais afetados. 68.73% dos óbitos ocorreram em hospital. **Conclusões:** A doença de Chagas ainda é um dos principais fatores de declínio da saúde pública no Brasil, sendo de extrema importância medidas de controle e melhorias no acesso ao diagnóstico e tratamento para redução do número de óbitos.

PALAVRAS-CHAVE: Brasil; Infecção por *Trypanosoma cruzi;* Registros de óbitos; Vigilância epidemiológica.

INTRODUCTION

Chagas disease (CD) is an anthropozoonotic endemic to the Americas caused by the flagellated protozoan *Trypanosoma cruzi* (*T. cruzi*)[1-3]. *T. cruzi* develops its life cycle in vertebrate (mammalian) and invertebrates blood-sucking triatomine insects, also known as kissing bugs (*Triatoma*, *Panstrongylus*, *Rhodnius*). Both vector genera are found throughout Latin America, from Mexico to Argentina and Chile, and inhabit environments ranging from forests to drier zones[1].

In humans, the parasite takes two forms. The trypomastigote forms have a flagellum that extends along the outer edge of a wavy membrane that assisting in their transport throughout the host's body. The amastigote, which does not have a flagellum, multiplies within different types of cells, preferring those of mesenchymal origin[2].

The main mode of transmission is through contact of injured skin and mucous membranes with the contaminated feces of insect vectors[2,3]. Oral transmission through food or drink contaminated with triatomine feces appears to cause more severe disease and higher mortality than the vector-borne disease[4,5].

The CD is endemic in 21 countries in continental Latin America, from the southern United States to northern Argentina and Chile. It has historically been confined to poor rural areas of Central and South America, where vector transmission is the primary mode of infection[2]. Brazil has an estimated 2.4 million cases of CD, with a predominance of chronic infections in patients living in large urban centers[6]. According to Pérez-Molina and Molina[2] the northern region of Brazil is considered endemic for Chagas disease transmission by the main vector, as vector control in the region has not reached ideal management.

The disease is divided into an acute and a chronic phase. Acute infection can occur at any age and is usually asymptomatic. Symptoms of the acute phase include fever, inflammation at the site of inoculation, unilateral eyelid edema (Romaña's sign; when the conjunctiva is the portal of entry), lymphadenopathy, and hepatosplenomegaly. It lasts 4 to 8 weeks, and parasitemia decreases significantly after 90 days. Severe acute infections occur in less than 5% of patients and include manifestations such as acute myocarditis, pericardial effusion, and meningoencephalitis, with a mortality risk of 0.5%[2,7].

The chronic phase can manifest as an indeterminate form and a cardiac and gastrointestinal form. The indeterminate form is asymptomatic, and patients present with a normal chest x-ray and 12-lead electrocardiogram (ECG). In the other forms, they have the following cardiac manifestations: fatigue, syncope, palpitations, dizziness, and stroke. Late manifestations: chest pain (atypical), dyspnea, edema, left ventricular dysfunction, congestive heart failure. Changes in 12-lead ECG, echocardiography, or other cardiac function tests. Gastrointestinal manifestations include dysphagia, regurgitation, and severe constipation (dilated esophagus or colon) [2,7].

Given the importance of CD in the Brazilian public health context, this study aimed to analyze the sociodemographic characteristics and geographic distribution of deaths related to Chagas disease in Brazil from 1996 to 2021.

METHODOLOGY

This is a descriptive, quantitative, cross-sectional, and epidemiological study. The object of study of this research was the notifications of death certificates related to Chagas disease in Brazil, issued between 1996 and 2021. The information comes from secondary and anonymous data provided by the Mortality Information System (*Sistema de Informações sobre Mortalidade* - SIM)[8]. Research involving only public domain data that does not identify participants does not require approval by Brazilian research ethics committees.

Data were collected in may 2023. The variables selected in the SIM[8] were raw number of deaths per year, spatial distribution of deaths, sociodemographic variables (sex, race, education, age group, and marital status), and location. The variables were transferred and analyzed using TabWin 4.15®, Excel®, and GraphPad Prism 6® and presented in figure and table formats. The map of the spatial distribution of deaths was generated using TabWin 4.15®.

To calculate the annual incidence, the number of mortalities from Chagas disease in each year, was used as the numerator and the Brazilian population by year, according to the Brazilian Demographic Census projection[9], as the denominator. The division was multiplied by per hundred thousand inhabitants, adapted from Oliveira et al.[10].

The statistical analysis related to the variation in the number of deaths each year was performed using GraphPad Prism 6®. The normality of the number of reports in the study period was assessed by the Kolmogorov-Smirnov test, which found a non-parametric distribution of the data. Data were subjected to Kruskal-Wallis's test and Dunn's multiple comparison test for comparison between groups. P-values <0.05 were considered significant.

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RESAP
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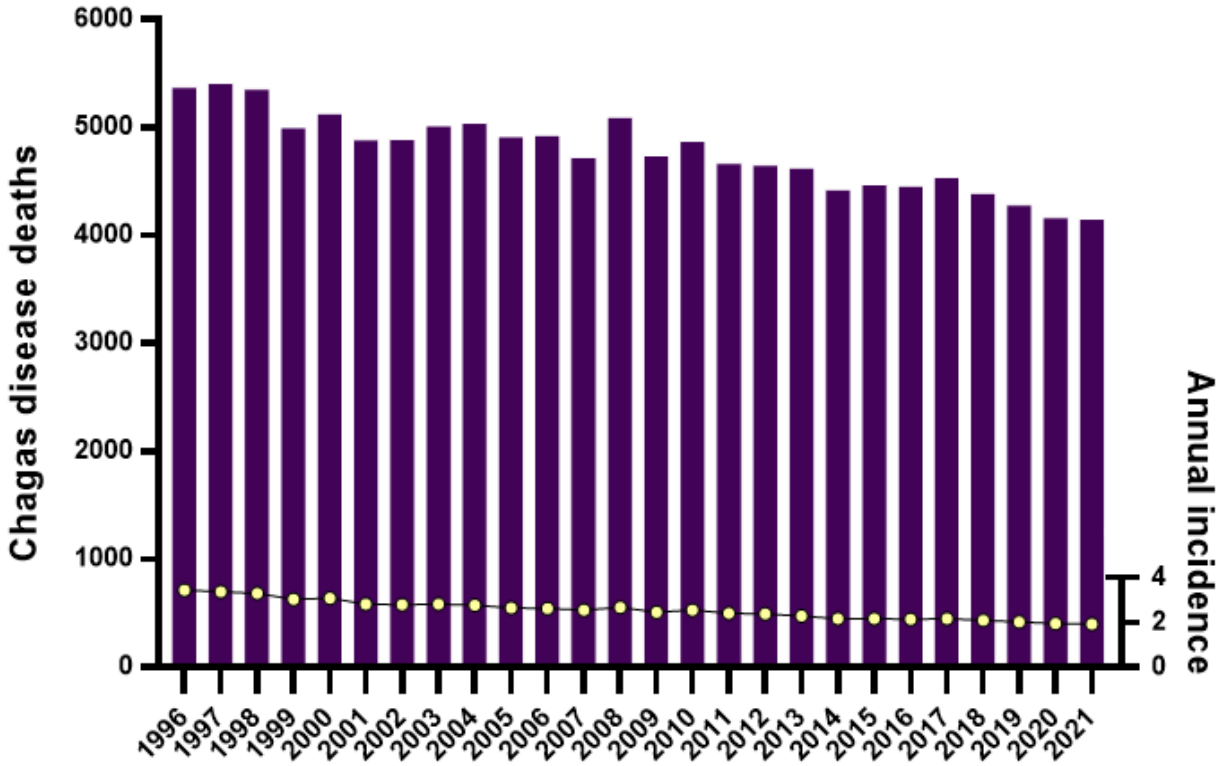
RESULTS

From 1996 to 2021, 124.255 deaths related to Chagas disease were reported in Brazil. The number of notifications per year and their annual incidence are shown in Figure 1. The bar graph represents the number of cases and should be analyzed with the y-axis on the left. The line graph with circular symbols refers to the annual incidence in the period studied and should be analyzed with the y-axis on the right of the figure. The statistical analysis did not identify significant differences between the notifications in the period studied.

Figure 1. Deaths related to Chagas disease and annual incidence in Brazil (1996-2021).



Source: Author's preparation with data from the SIM[8].

Figure 2 shows the spatial distribution of Chagas disease deaths according to the state in which the death occurred. Note that the states with a high prevalence of reported cases are Minas Gerais at 25.5%, São Paulo at 24.47%, Goiás at 16%, and Bahia at 12.1%.

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RESAP
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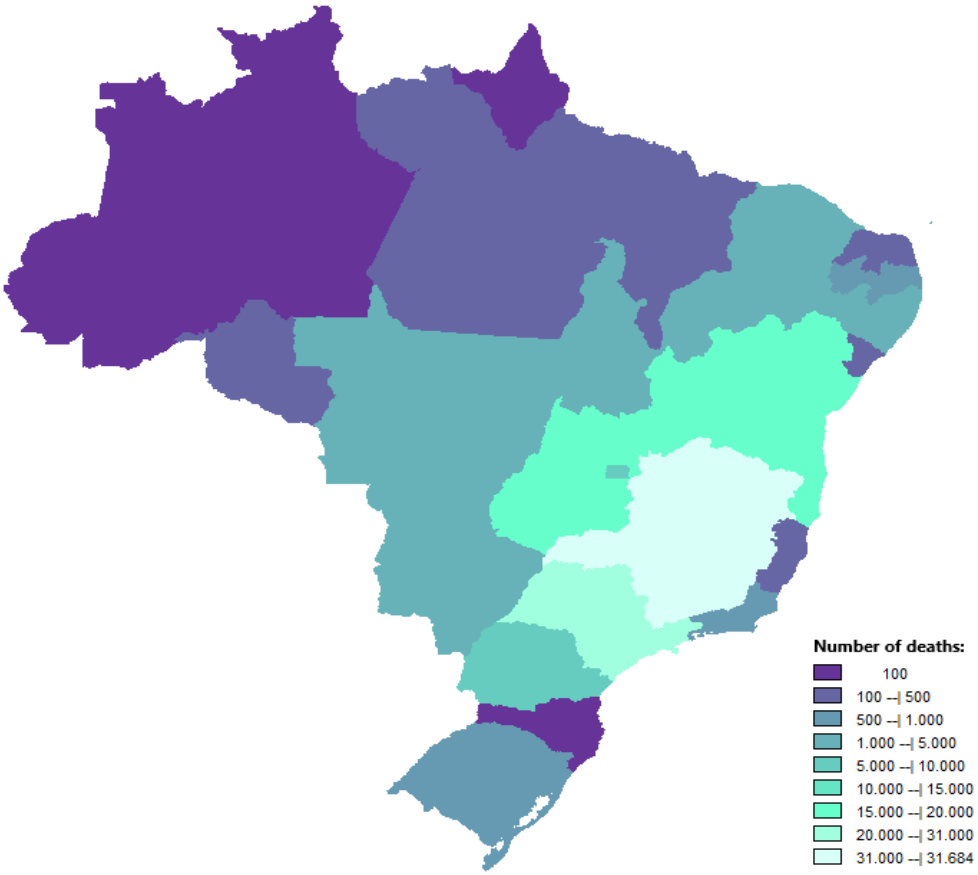
Figure 2. Geographic distribution of Chagas Disease deaths in Brazil (1996-2021)



Source: Author's preparation with data from the SIM[8]

Table 1 shows the socio-demographic characteristics of the deaths. It was possible to determine that males, whites, married, aged between 60 and 79 years, and with a low level of education are the prevalent characteristics of the victims who died from the conditions studied. Furthermore, 68.73% of deaths occurred in a hospital and 22.64% of them happened in the victims' homes.

Table 1. Socio-demographic characteristics of the deaths by Chagas Disease in Brazil (1996-2021)

Sex	**n**
Male	69.932
Female	54.266
Ignored/white	57

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ISSN 2447-3405
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Revista Científica da Escola Estadual de Saúde Pública de Goiás - "Cândido Santiago"

Table 1. Continuation of the table...

Race	**n**
White	48.540
Black	13.121
Yellow	634
Brown	41.596
Indigenous	145
Ignored/white	20.219
Educational levels	**n**
Illiterate	27.782
1 to 3 full years	26.644
4 to 7 full years	15.890
8 to 11 full years	4.988
Continua na próxima pagina	
Table 1: Continuação da página anterior	
12 years or older	1.331
1 to 8 full years	246
9 to 11 full years	228
Ignored/white	47.146
Age group	**n**
Less than 1 year	15
1-4 years	11
5-9 years	12
10-14 years old	46
15-19 years old	135
20-29 years old	1.250
30-39 years old	4.775
40-49 years old	12.078
50-59 years old	22.722
60-69 years old	30.453
70-79 years old	30.927
80 years or older	21.671
Age ignored	160
Marital status	**n**
Single	22.972
Married	56.859
Widower	27.937
Judicially separated	5.187
Other	2.125
Ignored/white	9.175

Source: Author's preparation with data from the SIM[8]. / **Caption: n** is the raw number of notifications related to the described feature.

DISCUSSION

The data analyzed in this study show stability in the incidence of Chagas' disease deaths from 1996 to 2021. Among the authors dealing with this issue, Martinez et al.[11] stand out, defending the position that small changes in the number of these cases are due to failures in the follow-up of these patients in the health system. This position is feasible since the study by Souza et al.[12] demonstrated that deaths from CD represented 80.3% of deaths from neglected tropical diseases in Brazil between 2008 and 2017.

The social variables of the deaths studied are in line with other authors. Mota et al.[13] showed that the male sex is the most prevalent in deaths due to infection. The work of Martinez et al. [11] showed that 60% of the deaths were male, and the age between 70 and 79 years was the most affected. Silva et al.[14] showed that 59.2% of those who died from CD were male and 56.4% were older than 60 years. In the study by Souza et al.[12], 55.05% were male and 96.5% were older than 40 years. In addition, other authors have described similar characteristics for CD deaths in Brazil[15,16.]

Martinez et al. [11] and Silva et al.[14] found that most deaths occurred among brown individuals, diverging from the findings of this manuscript.

The predominance of men in reporting is notorious. In terms of health, men tend to consider themselves invulnerable and do not easily seek the health system, considering self-care as a feminine practice, a fact of sociocultural nature[17]. As a result, men are vulnerable to the development of diseases, especially chronic ones, promoting an increase in morbidity and mortality rates[11,18]. In the scenario of CD, men are prone to contracting the infection due to their greater exposure to environments where they easily encounter the vectors of the disease[19].

Regarding the marital status of the victims, and in line with the study by Martins-Melo et al.[16], deaths were prevalent among married individuals.

The data found regarding the education of the deceased is like the research of Martinez et al. [11] and Martins-Melo et al.[16], as individuals with low education are the main victims of death by CD. One explanation for this is the fact that these individuals develop work activities in rural areas or inferior conditions, so the population is more often in contact with the vector barber[11,16,20]. Thus, the level of education is a protective social determinant of health, since the higher the level of education, the lower the likelihood of dying from Chagas.

Another important variable detected was the high number of deaths among people in the older age groups, as elucidated by Martins-Melo et al.[15], Martins-Melo et al.[16], and Martinez et al. [11]. Because these are deaths from a chronic disease, the adverse effects emerge over the years, it is understandable that it affects the older population more[21].

Therefore, it is important to develop and strengthen health policies that focus on the follow-up and treatment of patients with CD, to reduce the progression of the disease and the negative consequences of those infected when they reach old age[11].

In terms of geographic distribution, the states with the highest prevalence of deaths from CD identified in this research converge with the data presented by some studies.

The mortality rate described by Martins-Melo et al.[15] between 1999 and 2007 shows that the Central-West had the highest proportional mortality among other Brazilian regions. Martins-Melo et al.[16] and Souza et al.[12] found the highest number of deaths in the Southeast region of Brazil. The high mortality in this region can be explained by the intense migration of people from rural endemic areas to urban centers in the last three decades[22].

Unfilled variables in SIM notifications can significantly impact the analysis of deaths caused by Chagas disease. Incomplete or missing data related to patient demographics, diagnostic tests, and other relevant factors can lead to inaccurate assessments of the disease burden and hinder effective public health interventions. The absence of critical information limits the ability to identify high-risk populations, assess disease progression, evaluate treatment outcomes, and understand the epidemiology of Chagas[23,24].

CONCLUSIONS

In summary, Chagas disease remains a significant public health threat in Brazil because of its high mortality rate. Despite advances in the diagnosis and treatment of the disease, much remains to be done to control its spread and improve patient outcomes. Epidemiologic surveillance remains a critical aspect of Chagas disease control, allowing early detection of cases and prompt implementation of measures to prevent transmission of the disease.

It is essential to strengthen health systems, increase awareness of Chagas disease among healthcare providers and the public, and promote research and development of new diagnostics and treatments. Only through a

collaborative effort among multiple stakeholders can we hope to achieve the goal of eradicating Chagas disease in Brazil and beyond.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest to disclose.

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