

Gestational and congenital toxoplasmosis: an epidemiological profile of extreme poverty municipalities in Brazil

Toxoplasmose gestacional e congênita: um perfil epidemiológico dos municípios de extrema pobreza no Brasil

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Abstract

Objective: to evaluate the epidemiological profile of gestational and congenital toxoplasmosis in extreme poverty municipalities in Brazil from 2019 to 2022. **Methods:** this is an ecological study based on secondary data from the Information Technology Department of the Unified Health System (DATASUS). Information was collected on the number of notified cases of gestational and congenital toxoplasmosis, considering extreme poverty municipalities as the place of residence. The variables evaluated were region and race for gestational toxoplasmosis, age group, schooling, congenital toxoplasmosis, and gender. **Results:** between 2019 and 2022, 6,895 new cases of Gestational Toxoplasmosis (GT) and 1,677 new cases of Congenital Toxoplasmosis (CT) were reported in extreme poverty municipalities in Brazil. In terms of the country's regions, the highest number of cases was concentrated in the Northeast during the period analyzed. Regarding cases by race, black people were the only ones with a statistically significant upward trend in both diseases. Analyzing cases by sex in CT, there was a percentage increase in both sexes, but with high statistical significance in females. As for the age group in GT, women aged between 20 and 39 showed a significant upward trend. **Conclusion:** based on the analysis of the data, the absolute numbers point to a significant increase in cases, especially in 2022.

Keywords: congenital toxoplasma infections; epidemiological studies; extreme poverty; low-income population; toxoplasma gondii infection.

Resumo

Objetivo: avaliar a epidemiologia da toxoplasmose gestacional e congênita nos municípios brasileiros, em extrema pobreza, no período de 2019 a 2022. **Métodos:** estudo ecológico realizado com dados secundários do DATASUS. Foram coletadas informações do número de casos notificados de toxoplasmose gestacional e congênita, considerando municípios de extrema pobreza como local de residência. As variáveis avaliadas foram região e raça, sendo também segmentada para a toxoplasmose gestacional a faixa etária e escolaridade e para a toxoplasmose congênita, o sexo. **Resultados:** foram notificados no Brasil, no período de 2019 até 2022, 6.895 novos casos de Toxoplasmose Gestacional (TG) e 1.677 novos casos de Toxoplasmose Congênita (TC) nos municípios de extrema pobreza. Em relação às regiões, o maior número de casos se concentra no Nordeste. Sobre os casos por raça, os de pessoas negras foram os únicos com uma tendência de crescimento estatisticamente significante em ambas as doenças. Analisando os casos por sexo na TC, houve crescimento percentual em ambos os sexos, mas com alta significância estatística no feminino. Quanto à faixa etária na TG, as mulheres com 20 a 39 anos possuem uma tendência de crescimento significativa. **Conclusão:** diante disso, os números absolutos apontam para um aumento expressivo nos casos, especialmente em 2022.

Palavras-chave: infecções congênicas por toxoplasma; estudos epidemiológicos; pobreza extrema; população de baixa renda; infecção por toxoplasma gondii.

INTRODUCTION

Toxoplasmosis is an infection caused by the intracellular protozoan parasite *Toxoplasma gondii*. There are four ways for humans to acquire toxoplasmosis: ingestion of infectious oocysts from the environment or contaminated fruit/vegetables, vertical transmission from an infected mother to her fetus, ingestion of tissue cysts in the meat of an infected animal, and transmission through organ transplantation with a contaminated donor¹

develops Gestational Toxoplasmosis, in which *Toxoplasma gondii* can be transmitted via the transplacental route, triggering Congenital Toxoplasmosis. In the first trimester of pregnancy, this infection can cause more serious lesions. However, maternal infection that occurs in the last trimester, although more frequent, is less severe; therefore, during pregnancy, there is an increased risk of vertical transmission and a decrease in the severity of fetal involvement²

The fetus can be affected by the disease when the woman

It is important to note that when symptomatic, it presents

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with lymphadenopathy, commonly due to an enlarged posterior cervical nodule, fever, malaise, headache, asthenia, myalgia, maculopapular rash, odynophagia, adenomegaly, and hepatosplenomegaly. However, in congenital transmission, children may show the classic signs and symptoms of congenital toxoplasmosis (hydrocephalus, retinochoroiditis, cerebral calcification, and mental retardation), or they may be born without sequelae of the disease and may develop them during childhood or adulthood³

The seroprevalence of toxoplasmosis in pregnant women is 7.4% in Mexico, 23 to 84% in Brazil, 23.9% to 46% in Africa, 28% in North America, 33% in New Zealand, 37% in Chile, and 47% in Europe, revealing the global variability of the infection⁴

Between 2019 and 2022, there was a 43.66% increase in the frequency of new cases of congenital toxoplasmosis in Brazil, with the Southeast and Northeast regions standing out⁵. Socioeconomic status is one of the risk factors contributing to the high seroprevalence in Brazil⁶.

Extreme poverty municipalities have the highest proportion of people living on less than R\$200 per month.⁽⁷⁾ Studies on *Toxoplasma gondii* have linked inadequate sanitation to the disease, as many of these individuals supplement their water supplies by building wells on their properties, with their intakes very close to the ground, and contamination is likely in situations of flooding or runoff after rainfall, given the ability of oocysts to survive for long periods in water.⁽⁶⁾ In addition, the possible lack of access of many pregnant women to adequate prenatal care makes it difficult to diagnose gestational toxoplasmosis early and prevent congenital infection.

Knowing the distribution of gestational and congenital toxoplasmosis is essential, especially in extremely poor municipalities, so strategies can be found to prevent outbreaks of this disease in places of great scarcity. However, no studies dealing with congenital and gestational toxoplasmosis in Brazil's extremely poverty municipalities were found in a Pubmed search, demonstrating a gap in knowledge on this highly relevant subject. The aim of this study is, therefore, to assess the epidemiological profile of gestational and congenital toxoplasmosis in Brazil's extreme poverty municipalities between 2019 and 2022.

METHODS

This ecological study is based on secondary data from the Information Technology Department of the Unified Health System (DATASUS). The STROBE Statement—A Checklist of items that should be included in reports of cross-sectional studies was used. Information was collected on the number of notified cases of gestational and congenital toxoplasmosis through the Notifiable Diseases Information System (SINAN). Brazilian municipalities identified as extreme poverty, according to the Brazilian Institute of Geography and Statistics (IBGE) classification, were used as a filter, following the criteria

established by the World Bank, totaling 1,351 municipalities, and the selection period was between 2019 and 2022.

When segmenting cases of gestational toxoplasmosis, selections related to the individual's age group and education level were applied. In cases of congenital toxoplasmosis, the analysis focused on the gender variable. For both outcomes, the variables of the region of Brazil, according to place of residence and race, were also investigated.

A statistical analysis of the period from January 2019 to December 2022 was carried out using linear regression to describe trends in the number of cases. This analysis was applied to the total number of cases, to cases in the Northeast region, and to each race and age group. In addition, considering that linear regression is subject to errors, the R^2 coefficient of determination was used to assess its statistical significance. The tool used to carry out the statistical and descriptive analysis was Microsoft Excel.

This study did not require approval from the Research Ethics Committee (REC) because it only utilized secondary data made publicly available by DATASUS. According to CNS Resolution No. 510 of 2016, research using publicly available information, without the possibility of identifying research subjects, is exempt from REC submission. DATASUS data are anonymized and publicly accessible, ensuring the privacy and confidentiality of personal information.

In this study, the STROBE checklist was followed, adhering to the 22 steps required for conducting this research.

RESULTS

Between 2019 and 2022, 40,863 cases of Gestational Toxoplasmosis (GT) were reported in Brazil, with 6,895(16.95) cases in 1,223 extreme poverty municipalities and 14,192 cases of Congenital Toxoplasmosis (CT), with 1,677(11.81) cases in 679 extreme poverty municipalities.

Considering the municipalities in extreme poverty, the year with the highest number of GT and CT notifications was 2022, with 2,096 and 565, respectively. Throughout the time series, there was an upward trend in the number of cases reported between 2019 and 2022, with high statistical significance ($R^2 > 0.9$).

The Northeast region has the highest number of cases reported annually, according to figure 1.

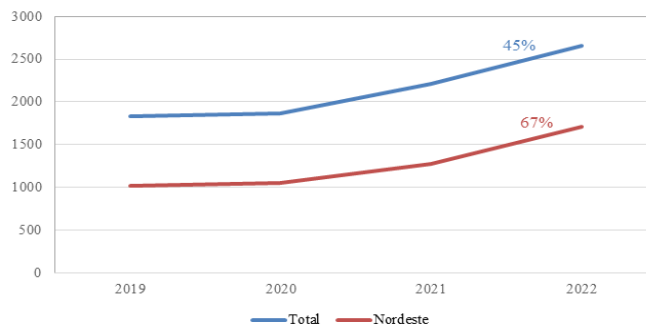
The period from 2019 to 2020 saw a decrease in cases (approximately -1%), with an increase from 2020 to 2021 of 335(21%) in GT and 38(6%) in CT; and 2021 to 2022 with 335(33%) in GT and 102(18%) in CT. There was a trend towards an increase in cases over the period analyzed for the Northeast ($R^2 = 0.82$) and Southeast ($R^2 = 0.80$) regions, while in the other regions, the growth trend was not statistically significant, according to Table 1.

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About cases reported by race, black people had a statistically significant upward trend in both diseases ($R^2>0.8$), with a percentage increase in 2022 also in white people. Comparing 2019 with 2022, there was an increase of 76(17%) in GT cases and 50(62%) in CT cases. The Asian and indigenous races, on the other hand, did not show a growth trend or a percentage increase in cases of both diseases.

Concerning GT cases by age group, only the 20-39 age group of women showed a statistically significant upward trend ($R^2>0.9$). Percentage-wise, comparing 2019 with 2022, there was an increase of 31% in the 10-19 age group, 42% in the 20-39 age group and 28% in the 40-59 age group.

Figure 1. Percentage comparison and sum of the number of notified cases of Gestational Toxoplasmosis and Congenital Toxoplasmosis with residents in the extreme poverty municipalities of Brazil and the Northeast from 2019 to 2022.



Source: DATASUS, 2024.

Table 1. PNumber of notified cases of Gestational and Congenital Toxoplasmosis from 2019 to 2022, with residence in extreme poverty municipalities, considering region of residence, race, sex, and age group, 2024.

Variables	Gestational				Congenital			
	2019	2020	2021	2022	2019	2020	2021	2022
Regions	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
North	261 (4)	253 (4)	327 (5)	266 (4)	57 (3)	60 (3)	64 (4)	76 (4)
Northeast	845 (12)	836 (12)	1013 (15)	1348 (19)	176 (10)	219 (13)	257 (15)	359 (21)
Southeast	176 (2)	237 (3)	232 (3)	261 (4)	44 (3)	42 (2)	54 (3)	64 (4)
Midwest	67 (1)	63 (1)	83 (1)	83 (1)	10 (1)	17 (1)	9 (1)	21 (1)
South	154 (2)	113 (2)	139 (2)	138 (2)	37 (2)	29 (2)	37 (2)	45 (3)
Race								
Blacks	998 (14)	1033 (15)	1266 (18)	1492 (22)	201 (12)	239 (14)	291 (17)	376 (22)
Whites	406 (6)	373 (5)	424 (6)	479 (7)	80 (5)	93 (5)	75 (4)	130 (8)
Yellows	14 (0)	11 (0)	16 (0)	15 (0)	1 (1)	1 (1)	-	1 (1)
Indigenous	30 (0)	30 (0)	26 (0)	29 (0)	10 (1)	10 (1)	14 (1)	8 (0)
Gender								
Male	-	-	-	-	170 (10)	183 (11)	193 (11)	297 (18)
Female	-	-	-	-	142 (8)	183 (11)	225 (13)	264 (16)
Age range								
15-19	337 (5)	306 (4)	423 (6)	444 (6)	-	-	-	-
20-39	1093 (16)	1139 (15)	1295 (19)	1561 (22)	-	-	-	-
40-59	42 (1)	32 (0)	38 (1)	54 (1)	-	-	-	-

Source: DATASUS, 2024.

DISCUSSION

This study shows a trend toward an increase in the number of cases of Gestational Toxoplasmosis (GT) and Congenital Toxoplasmosis (CT) in extreme poverty municipalities in Brazil between 2019 and 2022. There was a special focus on the Northeast region of Brazil, which had the highest number of notifications and percentage growth in cases of GT and CT, even surpassing the percentage growth at the national level (67% x 45%). As for gender, black women were the only ones to show

a statistically significant upward trend in both diseases (TG and TC). As for the age group, there was an upward trend in notifications of TG cases in women aged between 20 and 39.

In the Northeast, there is a wide distribution of *Toxoplasma gondii* infections in cattle, specifically in Paraíba, but also in horses, sheep, and goats⁸⁻¹¹, with the main source of contamination

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being water sources. Thus, both water sources and animals can be potential sources of human risk for developing the disease, as evidenced by the risk of consuming meat contaminated by the protozoan.

About the Brazilian health system, the literature reports the persistence of racial inequalities in health¹², revealing that black people have greater difficulty in accessing health services. As such, this study corroborates the literature by showing that blacks are the only race (compared to whites, Asians, and Indigenous people) to have shown an upward trend in cases of GT and CT. It suggests that difficulty in accessing health services may increase the number of cases since difficult access to health reduces the possibility of the triad of disease prevention, treatment, and cure.

In the literature, a study of pregnant women in Sergipe revealed that seropositivity for toxoplasmosis increased with age.⁽¹³⁾ However, we found that there was a smaller increase in the notification of cases for pregnant women aged 40 to 59 (28%) than for pregnant women aged 20 to 39 (42%). It is believed that the lower number of notifications in the 40 to 59 age group is probably related to the fact that this is an age group that is prone to menopause, i.e., there is a lower occurrence of pregnancies in women aged 40 to 59 than in women aged 20 to 39.

This ecological observational study was carried out entirely using secondary data collected from the Information Technology Department of the Unified Health System (DATASUS), and this leads to some limitations which will be mentioned below.

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