








Analysis and comparison of tuberculosis treatment outcomes in the homeless population and in the general population of Brazil

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Worldwide, tuberculosis remains a major public health problem in the 21st century, despite being a treatable and curable disease. In 2015, there were 10.4 million new tuberculosis cases and 1.4 million tuberculosis deaths,⁽¹⁾ tuberculosis being one of the leading causes of death in the world.⁽²⁾ In Brazil, strategies to fight tuberculosis include several government action plans⁽³⁻⁵⁾ and national initiatives to achieve the United Nations Sustainable Development Goals.⁽⁶⁾ Despite an improvement in tuberculosis indicators, Brazil ranked 20th among the countries with the highest tuberculosis burdens and 19th in terms of HIV/tuberculosis coinfection in the world in 2015, therefore remaining on the World Health Organization (WHO) list of priority countries for tuberculosis control in the 2016-2020 period.⁽³⁾

Obstacles to the control of tuberculosis in Brazil include historical difficulty in efficiently disseminating tuberculosis-related information, economic crises with negative impacts on poverty rates, unequal distribution of wealth, precarious urbanization, increased HIV infection, poor nutrition, poor sanitation, and an increase in vulnerable populations.⁽⁷⁻⁹⁾ Vulnerable populations include homeless individuals, who are particularly at risk for tuberculosis

because of extreme social exclusion, poor access to health care, violence, and discrimination, as well as strained or no family ties.^(7,10,11)

Studies have shown that homeless individuals are at an increased risk for tuberculosis, and rates of comorbidities are higher in the homeless than in the general population.⁽⁷⁻⁹⁾ However, no studies have examined a wider range of tuberculosis indicators in a large country like Brazil. Therefore, there is a need to study tuberculosis treatment outcomes in the homeless population of Brazil and compare them with those in the general population in order to gain a better understanding of this issue and contribute to the design of effective and equitable health policies. The objective of the present study was to compare the rates of tuberculosis treatment success, loss to follow-up, and tuberculosis mortality⁽⁴⁾ between the homeless population and the general population of Brazil (by region) in 2018.

This was a cross-sectional study of data from the Brazilian National Ministry of Health *Sistema de Informação de Agravos de Notificação* (SINAN, Case Registry Database). Reported new cases of tuberculosis (International Classification of Diseases, 10th revision

ABSTRACT

Tuberculosis remains a major public health problem deeply influenced by inequality. The present study used data from the Brazilian Tuberculosis Case Registry Database in order to compare the rates of tuberculosis treatment success, loss to follow-up, and tuberculosis mortality between the homeless population and the general population of Brazil. The likelihood of tuberculosis treatment success was reduced by approximately 50% in the homeless population. In addition, the rate of loss to follow-up was 2.9 times higher in the homeless population than in the general population, and the rate of tuberculosis mortality was 2.5 times higher in the former.

Keywords: Tuberculosis; Homeless persons; Health information systems; Health policy.

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codes A15-A16) were analyzed in the homeless and general populations. Confirmed tuberculosis was defined as clinically and laboratory or clinically and epidemiologically confirmed cases of tuberculosis, in accordance with the SINAN Tuberculosis Reporting/Surveillance Form definition.⁽¹²⁾ After exclusion of tuberculosis cases in special populations and those with missing data on outcomes of interest, 1,530 cases and 54,608 cases were analyzed in the homeless and general populations, respectively.

Outcomes of the study included treatment success, loss to follow-up, and tuberculosis mortality. All indicators were described for Brazil as a whole and for each region of the country. Case distribution was analyzed by sex, level of education, race, presence or absence of alcoholism, smoking status, HIV status, and presence or absence of mental disorder as recorded in the SINAN.⁽¹²⁾ Microdata were analyzed with the Stata statistical software package, version 14 (StataCorp LP, College Station, TX, USA). For the three outcomes, the relative differences between the groups were calculated with Pearson's chi-square test. Because the study used public, anonymized data, no research ethics committee approval was required or sought.

Pulmonary tuberculosis accounted for 91.9% of the tuberculosis cases in the homeless population and 81.7% of those in the general population. In the homeless and general populations, there was a predominance of males (83.5% and 65.1%, respectively), individuals who had had 9 years of schooling (83.2% and 69.8%, respectively), and biracial individuals (52.2% and 53.0%, respectively). The homeless and general

populations were significantly different in terms of the presence of alcoholism (58.4% vs. 16.8%), smoking (50.4% vs. 22.4%), HIV infection (21.2% vs. 9.1%), and mental disorder (7.3% vs. 2.3%).

The likelihood of tuberculosis treatment success was reduced by approximately 50% in the homeless population. The rate of loss to follow-up was 2.9 times higher in the homeless population than in the general population, and the rate of tuberculosis mortality was 2.5 times higher in the former (Table 1).

Tuberculosis indicators were found to be worse in the homeless population in all regions of the country (Table 1). The rate of successful tuberculosis treatment was highest in the general population in the southeastern region of the country (75.9%) and lowest in the homeless population in the southern region (33.5%). With regard to reported loss to follow-up, relative inequality was found to be highest in the northeastern region, whereas the northern region showed the highest rate of loss to follow-up in the homeless population. With regard to tuberculosis mortality, the rates were highest in the central-west and northern regions. These differences can be attributed to poor access to health care, failure to trace contacts of patients with confirmed tuberculosis, and poor infrastructure.⁽¹³⁾ In addition, according to the Brazilian Institute of Geography and Statistics, socioeconomic inequalities are deep in the northern and northeastern regions of Brazil.⁽¹⁴⁾

The results of the present study show that the homeless are particularly vulnerable to tuberculosis. These results corroborate those of a study conducted

Table 1. Rates, 95% CIs, and incidence ratios (IR) for tuberculosis treatment success, loss to follow-up, and tuberculosis mortality in the homeless population and in the general population of Brazil (by region) in 2018.

Population	Outcome									p*
	Treatment success			Loss to follow-up			Tuberculosis mortality			
	%	95% CI	IR ^a	%	95% CI	IR ^a	%	95% CI	IR ^a	
Brazil										< 0.001
Homeless (n = 1,530)	39.0	(36.5-41.4)	0.5	28.8	(26.6-31.1)	2.9	8.1	(6.8-9.6)	2.5	
General (n = 54,608)	71.9	(71.6-72.3)		9.9	(9.6-10.1)		3.3	(3.1-3.4)		
Northern region										< 0.001
Homeless (n = 83)	44.6	(34.1-55.6)	0.6	24.7	(16.0-34.7)	2.5	9.6	(4.8-18.3)	3.8	
General (n = 6,318)	72.4	(71.3-73.5)		11.0	(10.2-11.8)		2.6	(2.2-3.0)		
Northeastern region										< 0.001
Homeless (n = 243)	33.7	(28.0-40.0)	0.5	30.0	(24.6-36.1)	3.5	7.0	(4.4-11.0)	1.8	
General (n = 12,997)	68.2	(67.4-69.0)		8.5	(8.0-9.0)		3.8	(3.5-4.1)		
Southeastern region										< 0.001
Homeless (n = 1,869)	41.7	(38.4-45.0)	0.5	31.1	(28.1-34.2)	2.9	7.7	(6.1-9.7)	2.5	
General (n = 26,212)	75.9	(75.3-76.4)		10.6	(10.2-10.9)		3.1	(2.8-3.3)		
Southern region										< 0.001
Homeless (n = 248)	33.5	(27.8-39.6)	0.5	21.8	(17.0-27.4)	2.5	8.1	(5.2-12.2)	2.1	
General (n = 6,674)	66.6	(65.6-67.7)		8.6	(8.0-9.3)		3.9	(3.4-4.4)		
Central-west region										< 0.001
Homeless (n = 87)	36.8	(27.2-47.6)	0.6	27.6	(19.1-38.1)	2.7	13.8	(7.9-23.0)	4.6	
General (n = 2,407)	62.9	(61.0-64.9)		10.2	(9.1-11.5)		3.0	(2.4-3.8)		

Source: *Brasil. Ministério da Saúde. Sistema de Informação de Agravos de Notificação* (Brazilian National Ministry of Health Tuberculosis Case Registry Database).⁽¹²⁾ ^aThe homeless population was used as reference to calculate ORs. *Pearson's chi-square test.

in the state of São Paulo, Brazil, and showing that tuberculosis treatment failed in 57.3% of the homeless individuals, primarily because of loss to follow-up (39.0%) and death (10.5%).⁽⁹⁾

Data from the Brazilian National Ministry of Health show that approximately 11% of tuberculosis patients do not complete the full course of treatment, being consistent with the findings of the present study.⁽³⁾ The aforementioned rate is more than twice as high as the mean rate of treatment abandonment considered acceptable by the WHO (i.e., 5%).⁽²⁾ In the homeless population, the rate of loss to follow-up is 33%, which is approximately three times as high as that considered acceptable by the Brazilian National Ministry of Health and seven times as high as that considered acceptable by the WHO.

Tuberculosis outcomes were found to be worse in the homeless population than in the general population of Brazil in all regions of the country, regardless of social and health inequalities. Homeless individuals are autonomous and have specific health needs. Therefore, there is a need to expand the traditional biomedical approach in order to create bonds of trust and respect between patients and health care teams.⁽¹⁵⁾ In Brazil, street teams known as *Consultórios na Rua* are responsible for providing health care services to the homeless. However, although many Brazilian municipalities meet the criteria for *Consultórios na Rua*,⁽¹⁶⁾ only 30% had implemented street teams by the end of 2016.⁽¹⁷⁾ Although the number of street teams in Brazil has increased between 2016 and 2019,⁽¹⁸⁾ it is still 40% below expected.^(16,17) This is due to a lack of available health care professionals, a lack of prioritization of the health needs of the homeless, and a lack of adequate financial investment from the federal government, among other reasons.⁽¹⁷⁾

It is difficult to address the health needs of the homeless because of poor living conditions, mental health conditions, dependence on legal and illegal

drugs, comorbidities, marginalization, and limited access to health care.⁽¹⁹⁾ Therefore, it is important to increase access to health care services for the homeless, their needs being respected and addressed.⁽⁴⁾ Despite the efforts of health care professionals, the lack of collaboration among the various sectors involved in health care for the homeless can be an obstacle to providing effective health care⁽¹¹⁾ and achieving shared worldwide goals. Economic growth and a reduction in socioeconomic inequalities, as well as effective and equitable health policies, are also needed in order to meet the population needs, including housing needs.

Health information systems are important tools for evaluation and surveillance studies. However, they have limitations, including inconsistent and missing data.⁽²⁰⁾ Another possible limitation is the underreporting of tuberculosis in the SINAN. These limitations can be further exacerbated in specific patient groups, such as the homeless. Nevertheless, government health information systems are the best regular source of nationwide data, and their extensive use is an important strategy to improve data quality.

There is a need to improve current tools and create new ones that can address the complexities of providing health care for the homeless. In addition, there is a need to develop intersectoral collaboration to provide comprehensive and equitable health care to the homeless population, with a view to change the model of care for the homeless and, consequently, improve tuberculosis indicators.

AUTHOR CONTRIBUTIONS

ACES, CB, and LSP conceived and designed the study, analyzed the data, and drafted and revised the manuscript; SSS conceived and designed the study, collected and analyzed the data, and drafted the manuscript; AFB provided expert advice and guidance at all stages of the study and manuscript preparation process.

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