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Leprosy among female prisoners in Brazil

Hanseníase entre mulheres privadas de liberdade no Brasil

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Abstract *To estimate the prevalence of leprosy among Brazilian female prisoners and identify factors associated with the disease. Cross-sectional study conducted between 2014 and 2015 in 15 Brazilian female prisons. The data of 1,327 women were collected using Audio Computer-Assisted Self-Interviewing and dermatological and neurological examination to identify suspicious lesions of leprosy. The average age was 33.4 years. Suspicion of leprosy was identified in 5.1% of women in prison, and lifetime self-reported prevalence was 7.5%. The variables that were associated with lifetime self-reported leprosy were: women in prison once being twice as likely to have leprosy; white women were 1.4 time more likely to have leprosy than non-white women; women who knew someone with leprosy was 1.9 time more likely to have leprosy; and women who shared a cell with 11 or more women were 2.5 times more likely to have leprosy than women who shared a cell with two or fewer people. The leprosy prevalence among female prisoners in Brazil were greater than that found in a Brazilian woman of the general population and show the extremely high vulnerability of this population generated through pre-incarceration poverty, as well as potential transmission in prison.*

Key words *Leprosy, Female prisoners, Prisons, Brazil*

Resumo *Objetivou-se estimar a prevalência de hanseníase entre presidiárias brasileiras e identificar fatores associados à doença. Estudo transversal realizado entre 2014 e 2015 em 15 presídios femininos brasileiros. Os dados de 1.327 mulheres foram coletados por meio de autoentrevista assistida por computador e exame dermatológico e neurológico para identificar lesões suspeitas de hanseníase. A idade média foi de 33,4 anos. A suspeita de hanseníase foi identificada em 5,1% das mulheres na prisão, e a prevalência autorreferida ao longo da vida foi de 7,5%. As variáveis que se associaram à hanseníase autorrelatada ao longo da vida foram: mulheres presas uma vez com duas vezes mais chance de ter hanseníase; mulheres brancas tinham 1,4 vez mais chance de ter hanseníase do que mulheres não brancas; mulheres que conheciam alguém com hanseníase tinham 1,9 vez mais chance de ter hanseníase; e mulheres que compartilhavam uma cela com 11 ou mais mulheres tinham 2,5 vezes mais chance de ter hanseníase do que mulheres que compartilhavam uma cela com duas ou menos pessoas. A prevalencia de hanseníase entre presidiárias no Brasil foi maior do que a encontrada entre mulheres da população geral e evidencia a vulnerabilidade dessa população gerada pela pobreza pré-reclusão, bem como o potencial de transmissão na prisão.*

Palavras-chave *Hanseníase, Presidiárias, Presídios, Brasil*

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Introduction

Leprosy is a neglected infectious disease caused by a non-lethal and curable agent, which persists as an important public health problem in some developing countries[1]. Worldwide, nearly 210,000 new cases of the disease were reported in 2018[2], despite the rate of decline and the great global effort to eradicate it[3]. Of these, about 30,000 occurred in the region of the Americas, with Brazil being responsible for more than 92% of these notifications[3]. This number places the country in first place in new cases of the disease annually in the Americas and the only country on the continent that has not eliminated the disease[2].

Leprosy cases are associated with poor sanitary conditions, food insecurity, overcrowded environments and low socioeconomic and educational levels[4]. Brazil is an underdeveloped country with a long history of all these problems. In recent years, as a result of ultra-conservative and neoliberal governments, there has been an increase in several of these factors in Brazil. Individuals who live in regions with greater poverty in the country (Central-West, North and Northeast) had a risk of leprosy incidence five to eight times higher than other individuals[5]. Strategies that focus on early detection and treatment of leprosy in the poorest populations can contribute substantially to the global control of the disease[5].

The prison population is considered a key group for the control of leprosy, since prisons are places that present environmental and social conditions that favor transmission and illness. The prison population already comes from unfavorable life situations and when they enter the prison system there is a potentiation of these factors[6]. In addition, due to the respiratory transmission of leprosy and high turnover of people in prison, professionals working in these institutions and the community as a whole are at risk[7].

The Brazilian prison population is currently made up of more than 730,000 people[8]. In recent decades, there has been a significant increase in the number of women in prisons in the country. The female prison population in Brazil reached approximately 42,000, representing a growth of 656% between 2000 and 2016, much lower than the 19% growth rate among male prisoners[8]. There are few studies in the literature on leprosy in prisons. Therefore, much is unknown about the specific risks of leprosy transmission among prisoners. This article presents the results of the first national survey in Brazil about the health of female prisoners and adds to the scarce literature about this topic. The objective was to estimate the prevalence of leprosy among Brazilian female prisoners and identify factors associated with the disease.

Methods

Study design

This is a cross-sectional study carried out between 2014 and 2015 in 15 Brazilian female prisons located in the states of Pará and Rondônia (North region), Ceará (Northeast region), Federal District and Mato Grosso (Midwest region), São Paulo and Minas Gerais (Southeast region), Paraná and Rio Grande do Sul (South region).

Sampling procedures

Women in prison for at least six months in either a closed or semi-open regime were included in the study. Women who were deemed unable to participate by the prison system, or who did not have Portuguese as their main language were excluded. Initially, two states with the largest female prison populations in each of Brazil's five regions were intentionally selected[8]. Then, prisons were stratified by location (capital, metropolitan region or interior) and size. Only prisons with more than 75 inmates were included in the sample, since only these had health services. The minimum sample size was estimated at 2,518 residents. However, due to lengthy approval processes and withdrawal of several prisons, the final sample collected was 1,327 women, reducing power to 67%.

Data collect

Initially, data collection consisted of applying a questionnaire dealing with sociodemographic, prison and epidemiological characteristics, using Audio Computer-Assisted Self-Interviewing (ACASI) technology, to provide the interviewees with greater confidentiality and privacy in responses[9]. The Alcohol Use Disorders Identification Test (AUDIT)[10] was used to identify different patterns of alcohol consumption. The classification of alcohol consumption was stratified into two categories: low-risk and risk. Low-risk consumption refers to those who obtained 0 to 7 scores. Risk or high-risk consumption refers to those with scores above 8. Socioeconomic aspects, such as age, education level and number

of children, and prison variables, such as prison time and type of crime, were also investigated. Race (mixed, black, white and yellow) was self-reported, following the criteria established in Brazil.

Subsequently, a dermatological and neurological examination was performed to identify suspicious lesions of leprosy. Suspected cases were defined as women with skin lesions with altered sensitivity and/or nerve involvement[3]. However, leprosy is a disease with a long incubation period but a relatively short treatment, lifetime self-report of leprosy used as the outcome to identify risk factors.

Data analysis

Data were analyzed using STATA 15.0 software. Factors associated with lifetime self-report of leprosy were identified in bivariate analysis with chi square and Fisher's exact test. Independent variables that present a relationship with the dependent variable at a level of $p<0.20$ were selected, along with variables identified in the literature. These variables were used in a multivariate model in logistic regression. Variables that presented a p-value<0.05 in the final model were considered statistically significant. The risk was estimated by calculating the Odds Ratio (OR) and respective confidence intervals.

Ethics approval

The study was approved for the Research Ethics Committee of the Federal University of Ceará, under CEP protocol No. 1,024,053. For the consent to participate in the study, the participants signed a Free and Informed Consent Form and was informed that she could stop participating in the study at any time. Informed consent was obtained from all individual participants included in the study.

Results

The total sample consisted of 1,327 women prisoners. The average age was 33.4 years (95%CI=32.8-33.9), with 27.5 years (95%CI=27.0-28.1) being the average age of the first incarceration. Of the total, 49.8% were race classification *parda* and 34.7% fell between the 4th and 7th grade of elementary school. Only 10% were married or had a stable relationship and 43.5% did not report any partner. Most of the women reported never being homeless and reported Catholicism as their religion. With respect to prior occupation, 22.7% were unemployed, 25.4% worked in commerce and service provision, 23.7% as housemaids and only 1.4% reported a higher-level professional activity. Thirty-six point five per cent were the main source of livelihood for their households before being arrested, 34% participated in the national income subsidy program *Bolsa Família*, 91% had no health insurance and 81.5% were mothers (Table 1).

Leprosy was suspected in 5.1% of women in prison following skin exams. About 4% (95%CI=3.1-5.0) had 1 to 5 lesions and almost 1% (95%CI=0.4-1.3) had more than five lesions. In addition, 0.8% (95%CI=0.5-1.4) reported a change in thermal sensitivity, 0.9% (95%CI=0.5-1.6) in pain sensitivity and 0.8% (95%CI=0.5–1.5) in tactile sensitivity. Approximately 2% (95%CI=1.2–2.3) of the women reported no sensation.

The prevalence of lifetime self-reported leprosy was 7.5% (95%CI=6.2-9.1). The variables associated with self-reported leprosy in the bivariate analysis were (Table 2): being white (p=0.009); not being the main source of family income (p=0.032); imprisoned only once (p=0.025); did not study in prison (p=0.049); did not receive an intimate visit in prison (p=0.028); and knew someone who has or has had leprosy (p=0.025) (Table 2).

In the multivariate model, the variables that were shown to be statistically associated with self-reported leprosy were: women in prison once being twice as likely to have leprosy (95%CI=1.2-3.5); white women were 1.4 time more likely to have leprosy than non-white women (95%CI=1.1-1.8); women who knew someone with leprosy was 1.9 time more likely to have leprosy (95%CI=1.1-3.3); and women who shared a cell with 11 or more women were 2.5 times more likely to have leprosy than women who shared a cell with two or fewer people (95%CI=1.1-5.9) (Table 3).

Discussion

The prevalence of suspected leprosy in prison (5.1%) and self-reported lifetime leprosy (7.5%) were more than 100 times greater than that found in a Brazilian cohort of the general population[5]. These values show the extremely high vulnerability of this population generated through pre-incarceration poverty[11], as well as potential trans-

mission in prison. Although leprosy in prisons has been very little studied, other studies have found high prevalence, such as in prisons in the state of Rio de Janeiro among inmates of both

Table 1. Sociodemographic characteristics of female prisoners in Brazil.

Variables	%	95%IC
Age group (N=1,327)		
<30 years old	43.9	40.8-46.5
30-49 years old	47.6	44.9-50.7
>50 years	8.5	7.0-10.2
Race (N=1,318)		
Black	15.3	13.3-17.6
Parda	49.8	47.0-52.5
White	31.5	28.9-34.2
Yellow	2.4	1.7-3.4
Indigenous	1.0	0.6-1.7
Education (N=1,324)		
Illiterate	3.0	2.2-4.2
1st to 3rd grade of elementary school	10.6	8.9-12.5
4th to 7th grade of elementary school	34.7	32.0-37.5
Complete elementary school	16.1	14.0-18.5
Incomplete high school	17.0	15.0-19.3
Complete high school	14.9	12.9-17.1
Incomplete undergraduate	2.4	1.6-3.6
Complete undergraduate	1.2	0.8-2.0
Marital status (N=1,325)		
Single and without a fixed partner	43.5	40.7-46.3
Has a male fixed partner	22.0	19.7-24.5
Has a female fixed partner	24.5	22.1-27.2
Married or stable	10.0	8.4-11.9
Lived on the street (N=1,326)		
No	85.8	83.7-87.7
Yes	14.2	12.3-16.3
Religion (N=1,313)		
I have no religion or belief	14.5	12.6-16.6
Catholic	41.6	38.8-44.5
Evangelical	37.8	35.0-40.6
Spiritism	5.6	4.3-7.2
Other	0.6	0.2-1.3
Before being arrested, she was the main source of income for the family (N=1,325)		
No	63.5	60.7-66.3
Yes	36.5	33.7-39.3
Currently, she is the main source of family income (N=1,324)		
No	88.7	86.9-90.4
Yes	11.3	9.5-13.0
Participates in income transfer programs (N=1,311)		
No	59.4	56.5-62.3
Yes	40.6	37.7-43.5
Has health insurance (N=1,319)		
No	91.0	89.4-92.5
Yes	9.0	7.4-10.5

%=weighted estimate.

Source: Authors.

sexes, with an estimated prevalence of 6.3%[6]. In eight prisons in a state in India in 1996, the incidence of leprosy was 13.3 per 1,000 prisoners, 12 times higher than that found for the general population of that state, but much lower than that found in Brazilian women's prisons[12].

Table 2. Factors associated with self-reported leprosy among Brazilian female prisoners.

	Leprosy						p	OR	95%IC	
	Yes			No						
	%	95%IC		%	95%IC					
Age (years)										
<30	7.2	5.3	9.8	92.8	90.2	94.7	0.945	1.000	-	-
30 |-- 40	7.6	5.5	10.6	92.4	89.4	94.5		1.062	0.651	1.733
≥40	7.8	5.2	11.5	92.2	88.5	94.8		1.089	0.634	1.870
Race black/*parda*										
Yes	6.1	4.7	7.9	93.9	92.1	95.3	0.009	1.000	-	-
No	10.2	7.7	13.5	89.8	86.5	92.3		1.759	1.148	2.695
Education										
Illiterate/Incomplete Fundamental	4.5	2.4	8.2	95.5	91.8	97.6	0.001	1.000	-	-
4th to 7th grade of elementary school	6.9	4.9	9.7	93.1	90.3	95.1		1.596	0.762	3.343
Complete elementary school	5.8	3.9	8.6	94.2	91.4	96.1		1.317	0.610	2.844
High school/Undergraduate	13.2	9.3	18.5	86.8	81.5	90.7		3.262	1.528	6.965
Marital status										
Single and without a fixed partner	8.4	6.4	10.9	91.6	89.1	93.6	0.350	1.672	0.696	4.015
Has a fixed partner	5.7	3.6	8.9	94.3	91.1	96.4		1.103	0.426	2.854
Married or stable	8.6	5.8	12.5	91.4	87.5	94.2		1.712	0.676	4.340
Other	5.2	2.3	11.1	94.8	88.9	97.7		1.000	-	-
Homeless										
No	7.8	6.4	9.6	92.2	90.4	93.6	0.309	1.414	0.724	2.761
Yes	5.7	3.1	10.1	94.3	89.9	96.9		1.000	-	-
Religion										
I have no religion or belief	7.5	4.4	12.4	92.5	87.6	95.6	0.356	1.135	0.586	2.200
Catholic	9.0	6.8	11.9	91.0	88.1	93.2		1.397	0.875	2.231
Evangelical	6.6	4.8	9.1	93.4	90.9	95.2		1.000	-	-
Before being arrested, were you the main source of income for your family?										
No	7.3	5.7	9.3	92.7	90.7	94.3	0.761	1.000	-	-
Yes	7.8	5.7	10.7	92.2	89.3	94.3		1.070	0.691	1.657
Inmate's monthly income (minimum wage - BRL 678) before being arrested										
No income	11.3	7.7	16.2	88.7	83.8	92.3	0.081	2.120	1.000	4.134
0 --| 1 minimal wage	6.2	4.2	9.1	93.8	90.9	95.8		1.106	0.574	2.131
1 --| 2 minimal wages	8.5	5.9	12.1	91.5	87.9	94.1		1.544	0.806	2.960
>2 minimal wages	5.7	3.5	9.1	94.3	90.9	96.5		1.000	-	-
Are you your family's main source of income today?										
No	8.0	6.6	9.8	92.0	90.2	93.4	0.032	2.328	1.050	5.161
Yes	3.6	1.7	7.4	96.4	92.6	98.3		1.000	-	-

it continues

Table 2. Factors associated with self-reported leprosy among Brazilian female prisoners.

	Leprosy						p	OR	95%IC	
	Yes			No						
	%	95%IC		%	95%IC					
Participate in cash transfer programs?										
No	8.2	6.4	10.4	91.8	89.6	93.6	0.231	1.308	0.842	2.030
Yes	6.4	4.6	8.7	93.6	91.3	95.4		1.000	-	-
How many times have you been arrested?										
1	9.5	7.4	12.1	90.5	87.9	92.6	0.025	1.919	1.130	3.258
2	5.2	3.4	7.9	94.8	92.1	96.6		1.000	-	-
3 or more	5.8	3.6	9.3	94.2	90.7	96.4		1.134	0.576	2.235
How many people are currently sharing a cell with you?										
0 to 2	4.0	1.8	8.7	96.0	91.3	98.2	0.097	1.000	-	-
3 to 10	6.0	3.7	9.6	94.0	90.4	96.3		1.514	0.577	3.972
11 or more	8.5	6.8	10.5	91.5	89.5	93.2		2.199	0.940	5.143
Are you currently studying in prison?										
No	8.4	6.7	10.4	91.6	89.6	93.3	0.049	1.600	1.000	2.564
Yes	5.4	3.7	7.8	94.6	92.2	96.3		1.000	-	-
Do you have any paid work in prison?										
No	7.0	5.4	9.1	93.0	90.9	94.6	0.470	1.000	-	-
Yes	8.1	6.0	10.8	91.9	89.2	94.0		1.171	0.763	1.796
Do you receive a sexual visit inside the prison?										
No	7.9	6.4	9.6	92.1	90.4	93.6	0.028	2.529	1.072	5.970
Yes	3.3	1.5	7.2	96.7	92.8	98.5		1.000	-	-
Do you have any skin problems?										
No	8.1	6.6	10.0	91.9	90.0	93.4	0.069	1.000	-	-
Yes	5.0	3.0	8.2	95.0	91.8	97.0		0.589	0.330	1.049
Do you know someone who has or has had leprosy?										
No	6.8	5.5	8.4	93.2	91.6	94.5	0.025	1.000	-	-
Yes	11.6	7.6	17.3	88.4	82.7	92.4		1.800	1.070	3.030
Have you lived with someone who has had leprosy in the same house or cell										
No	11.3	6.6	18.6	88.7	81.4	93.4	0.812	1.000	-	-
Yes	12.5	6.4	22.8	87.5	77.2	93.6		1.120	0.439	2.860

Source: Authors.

Table 3. Multivariate model of factors associated with leprosy among Brazilian female prisoners.

	OR	95%IC		p
Number of times arrested				
1 time versus 2 times	2.0	1.2	3.5	0.012
Race				
White *versus* Black/*Parda*	1.4	1.1	1.8	0.002
Know someone who has or has had leprosy	1.9	1.1	3.3	0.020
Number of people sharing cell				
0-2 *versus* 11 or more	2.5	1.1	5.9	0.035

Source: Authors.

This high prevalence of leprosy among inmates can be explained by the combination of the great socioeconomic inequalities of the prison population prior to prison and the structural problems of prison system[13], including overcrowding cells, poor ventilation and little access to health services[7]. Overcrowding is a factor in our study. Women who shared a cell with 11 or more women were 2.5 times more likely to have leprosy than women who shared a cell with up to 2 people. Overcrowding is considered by Human Right[14] to be one of the biggest problems in the Brazilian prison system and a major constraint on human rights. Overcrowding has more than one explanatory factor, but it largely stems from the inmates' difficulty in obtaining house arrest and other alternative sentences, which is a right of women with children younger than 12 years of age, and who committed minor crimes. This difficulty is felt mainly by poor prisoners. Thus, poverty is criminalized and the penitentiary system is used as an instrument to maintain order. This explains overcrowded prisons, when few crimes are investigated by the police[15].

Although the prison population has higher leprosy prevalence rates than the general population, unlike tuberculosis, whose risks in prison populations are clearly established, there is still no scientific evidence of a causal association between prisons and leprosy. Researchers who conducted a study in prisons in the state of São Paulo argue that given the long incubation period of leprosy and a median time of confinement of prisoners between 36 and 39 months, it can be inferred that the transmission of leprosy does not occur within the prison unit, but probably in their respective communities of origin, that is, before incarceration[16]. While prisoners do come from poverty-stricken areas presenting leprosy risk, and do report illnesses upon arrival in prison[6], these arguments do not make sense of our finding that cell occupancy is associated with leprosy. Wherever the index case is from, it is certainly possible that transmission happens in prison settings.

This study has some limitations. Because coercion can be used, prison populations are considered vulnerable and therefore, the access of researchers to this population faces a series of regulatory obstacles. Despite judicial authorization, prisons in the state of Pernambuco refused to participate, which reduced the sample size. In São Paulo, a state with the largest prison population in the country and in our sample, only two of the six selected prisons participated. To assess the impact of this loss, we compared the HIV prevalence found in our study (2.6%) with that obtained from a recent study involving the universe of women's prisons in the State of São Paulo (2.8%). There was no statistical difference between the two results. We take this result as a proxy for the representativeness of our sample in this state.

Our results suggest that the prevalence of leprosy in the Brazilian prison system is much higher than that found in the general Brazilian population and in prisons in other countries, and that prisons may be a source of transmission. Measures for the early detection and treatment of leprosy in prisons need to be implemented aiming at the prevention and control of this disease both in the prison population and in the community in general. Without these measures, prisons function as hyperendemic pockets and a two-way street with the community, representing a major obstacle to disease control.

Restrictions in government spending due to federal economic policy increasing unemployment[17], informal work[18], hunger[19] and poverty[20] that favor the increase in leprosy combined with punitive policies directed to prisoners and endless and distracting federal government preoccupation with their public health denying stance to the COVID-19 pandemic, provided a perfect scenario for the high levels of leprosy in Brazilian prisons and in the community to go unnoticed and untreated. These factors suggest that the prevalence of leprosy in prison and in the community may become an even greater public health problem.

Collaborations

EO Parente, M Leal and L Kerr conceived the paper. M Leal and RMS Mota developed the analysis plan. M Leal and RMS Mota carried out the analysis and wrote the initial draft of the manuscript. C Kendall, RJ Pires Neto and RHM Macena contributed to the analysis and interpretation of results. All authors reviewed earlier versions of the draft and approved the final manuscript.

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