

Social determinants of health and unfavourable outcome of tuberculosis treatment in the prison system

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Abstract *This article aims to analyze the unfavorable outcome of tuberculosis treatment among the population deprived of liberty by social determinants of health. This retrospective cohort was conducted in the states of Rondônia and São Paulo, Brazil, with inmates with tuberculosis notified between 2008 and 2017. Data were collected from SINAN and TB-WEB and analyzed by relative risk (RR) and confidence intervals (95%CI), which tested the association between the dependent variable (unfavorable outcome (deaths from tuberculosis and other causes, and primary and non-primary lost to follow-up) vs. favorable outcome (cure)) and the structural and intermediary determinants of health. One hundred fifty-eight unfavorable outcomes were registered in Rondônia and 2,227 in São Paulo. For Rondônia, this outcome was associated with gender (RR 3.09; 95%CI 1.03-9.27) and AIDS (RR 2.46; 95%CI 1.63-3.71). In São Paulo, aged over 30 years (RR 1.36; 95%CI 1.26-1.47), AIDS (RR 3.08; 95%CI 2.81-3.38), alcohol abuse (RR 1.54; 95%CI 1.35-1.76), diabetes (RR 1.70; 95%CI 1.27-2.28) and self-administered treatment (RR 2.55; 95%CI 2.27-2.86) were risk factors for the unfavorable outcome. The study contributes with elements to the risk stratification of people with tuberculosis in prison units and, thus, improves health care towards a favorable outcome.*

Key words *Tuberculosis, Prisons, Treatment outcome, Social determinants of health, Health policy*

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Introduction

The prison system is an important marker of imbalance and social inequalities in a historical context, in which cultural, financial, and organizational aspects are associated with the marginalization reproduced in the citizen versus State relationship, with its punitive character¹. According to the Penal Execution Law (LEP) n° 7.210/1984, the State protects those who are deprived of liberty and must guarantee these people in custody their fundamental rights, which are linked to the 1988 Brazilian Constitution, in which health is a right for all and a duty of the State². Therefore, prison and public health are directly related to the issue of the right and access to health.

In this context, tuberculosis (TB) is an endemic disease in prison environments due to the conditions and situations of confinement, overcrowding, insalubrity, and inadequacy of infrastructure, ventilation, lighting, and food, besides the deficient supply of human resources and the administrative, political and judiciary processes that hamper articulation with the health system³⁻⁵. In this sense, people deprived of liberty (PDL) are known to be 35 times more likely to develop TB than the general population⁶, showing that incarceration makes these individuals vulnerable to illness, which is closely related to social and health inequalities¹.

More than 700,000 people in deprivation of liberty in all prison regimes are estimated for Brazil, with a deficit of more than 350,000 vacancies, ranking third among countries with the largest prison populations worldwide, after the United States and China⁷. It is noteworthy that 7.8% of notifications of new TB cases are attributed to the prison population^{8,9} and that 54% of *M. tuberculosis* strains in urban populations are related to people in prisons, reinforcing that TB control in these environments is essential to reduce the incidence and prevalence of the disease, including in extramural environments¹⁰.

However, although the National Policy for Comprehensive Health Care for the Prison Population (PNAISP) ensures the effective and systematic access of PDLs to comprehensive health care through the provision of health actions in prison units enabled by the Unified Health System (SUS)¹¹, health as a right of ethical-human care and citizenship lacks prioritization¹² since TB mortality reaches 52% in prisons in the state of Rio de Janeiro¹³ and 7.4% and 16.9% of PDLs abandoned treatment in Pernambuco¹⁴ and Paraíba¹⁵, respectively. These unfavorable TB

treatment outcomes are high and distant from the goals proposed by the World Health Organization (WHO) of a maximum of 5% for treatment lost to follow-up and a minimum of 85% for cure, with the proposed reduction of 95% of deaths from the disease¹⁶.

Resumption of discussions on social determinants of health (SDH) by the Commission for Social Determinants of Health (CSDH) in the 21st century led to the understanding that the circumstances in which populations grow, live, work, and age and the systems implemented to address illness are shaped by political, social and economic forces¹⁷, with an interface with the structural and intermediate determinants of health, which, if not modified, impact health equity and society's well-being¹⁸.

Health inequality studies are grounded on the assumption that it is necessary to condition the health-disease processes and the distribution of mortality, disability, and morbidity by social classes, race, gender, schooling, or risk settings. When placing people and populations in situations of inequality concerning access to the minimum conditions of a dignified human life and the resources necessary to maintain adequate health and quality of life, the SDHs become unfair and avoidable social inequalities^{19,20}.

Thus, considering that TB is a public health issue in the prison system because of the vulnerability resulting from social and health imbalances and inequalities, this study aimed to analyze the unfavorable outcome of TB cases among the PDLs in two Brazilian states by SDHs to support reflections on coping with the disease in the light of the CSDH theory¹⁷, represented by the model proposed by Solar and Irwin¹⁸ and adopted by the WHO.

Methods

This retrospective, quantitative cohort study was conducted in two Brazilian states – Rondônia and São Paulo – due to their different geographic, demographic, and related health and incarceration services configurations, which influence the SDH analysis.

The state of Rondônia has 47 prisons with 14,043 people deprived of their liberty as of June 2021, which includes inmates in closed (5,104), open (3,282), semi-open (3,209), provisional (1,886), house arrest (441), and security measures (40)²¹ regimes. As for the organization of health services, the state has Penitentiary Prima-

ry Health Care (PHC) Teams, which, while not composed equally, are responsible for the care, follow-up, and surveillance of diseases and comorbidities among the PDLs, besides the referral to other outpatient or hospital support services.

The state of São Paulo has 178 prisons²², with 231,287 people deprived of their liberty as of 2019, which includes inmates in closed (142,538), provisional (46,298), semi-open (41,137), security measures (733), and outpatient treatment (4) regimes⁷. State prison units must cover the list of PHC actions and services through health care centers and ensure referral to other care levels, offering medical, nursing, psychological, and social visits for the continuity of care.

As a study population, all TB cases reported as PDLs were considered in Notifiable Diseases Information System – SINAN (for Rondônia) and TB-WEB (for São Paulo) from 2008 to 2017. The study's dependent variable corresponded to the outcome of the cases (unfavorable outcome versus favorable outcome). Thus, all cases of deaths from TB and other causes were included in an unfavorable outcome, besides primary or non-primary lost to follow-up. Cases whose treatment termination was recorded as a cure were the favorable outcome group. There was no concern with the pairing of the study subjects since all reported cases from both states ending with death, lost to follow-up, and cure were included in the period considered for the study.

In order to align the analysis of unfavorable TB treatment outcomes in light of the SDH model^{17,18}, the exposure variables included sociodemographic characteristics (gender, race/skin color, age group, and schooling), which refer to the structural determinants of health inequalities and generators of social stratification; living conditions, population behavior, and health services, which comprise the intermediate determinants of health. Among these variables, comorbidities (AIDS, diabetes, alcohol abuse, tobacco use, use of illicit drugs, and mental disorders) and the type of treatment indicated (directly observed treatment – DOT or self-administered treatment) stand out. We should emphasize that the exposure variables are related to the data at the outset of the treatment.

The collected data were analyzed using frequency distribution and univariate analysis, using the EpiR library of the R/RStudio program, version 1.2.5033. In the univariate analysis, the risk of occurrence of the dependent variable (unfavorable outcome) per the independent variables was established by the relative risk (RR) and

respective confidence intervals, with a 5% significance level. Notably, for the variables race/skin color, schooling, comorbidities, and DOT, invalid responses (blank or unknown) were not considered for the analyses. The dataset that composed the results of this study is available through the link: <https://doi.org/10.48331/scielodata.4ZJILH>.

In compliance with the recommendations of Resolution N° 466/12 of the National Health Council, which has human research guidelines and regulatory standards²³, this study was approved by the Research Ethics Committee of the Foundation of the Federal University of Rondônia under Opinion n° 3.939.112, and the University of São Paulo, Ribeirão Preto Nursing School, under Opinion n° 3.461.912.

Results

From 2008 to 2017, 782 TB cases were reported among the PDLs in Rondônia, of which 149 (19.1%) lost to follow-up and nine (1.2%) resulted in death, totaling 158 (20.2%) unfavorable outcomes, compared to 550 cure cases (70.3%). In the same period, São Paulo reported 23,950 TB cases among the PDLs, with 1,760 (7.3%) lost to follow-up cases and 467 deaths (1.9%), making a total of 2,227 (9.3%) unfavorable outcomes against 21,057 cure cases (87.9%).

For the state of Rondônia, a higher risk for the unfavorable outcome of TB treatment was identified for males (RR 3.09; 95%CI 1.03-9.27) and having AIDS (RR 2.46; 95%CI 1.63-3.71). Race/skin color, age group, schooling, comorbidities (alcohol abuse, diabetes, mental disorder, use of illicit drugs, and tobacco use), and type of treatment were not statistically significant and, therefore, were not associated with an unfavorable outcome of TB treatment among the PDLs (Table 1).

In the state of São Paulo, being male (RR 0.40; 95%CI 0.34-0.46) and tobacco use (RR 0.80; 95%CI 0.70-0.92) were protective factors for the unfavorable outcome of TB, while those over 30 years of age (RR 1.36; 95%CI 1.26-1.47), who had AIDS (RR 3.08; 95%CI 2.81-3.38), diabetes (RR 1.70; 95%CI 1.27-2.28), alcohol abuse (RR 1.54; 95%CI 1.35-1.76), and self-administered their treatment (RR 2.55; 95%CI 2.27-2.86) were more likely to have the unfavorable outcome of TB treatment. Race/skin color, years of schooling, and other comorbidities, such as illicit drug use and mental disorders, were not statistically significant and, thus, not associated with an un-

favorable outcome of TB treatment among PDLs (Table 2).

Discussion

Based on the results of this study, a significant difference was identified regarding the number of TB cases between the PDLs of the two states, besides a heterogeneous number regarding the outcomes of TB treatment, with a higher percentage of lost to follow-up cases in Rondônia, and deaths in the state of São Paulo. However, the cure was proportionally higher in the latter. These findings reveal the divergences regarding the loco-regional, epidemiological, socioeconomic, and organizational specificities of the services that can influence the analysis of the SDH and the possibilities of reducing vulnerabilities with potential reflections on illness and unfavorable outcomes.

In these contexts, the assurance of PDL access to comprehensive health care by the PNAISP¹¹ and the intersectoral articulation between the justice and public security bodies for this population are recommended, aiming at a line of care for people with TB²⁴. However, within the SDH model^{17,18}, social services, and health systems, when not put into practice, reinforce that the ethics of care in the prison system ends up not being based on health but on justice or safety, which significantly impacts health equity and PDLs' well-being, resulting in unfavorable outcomes of TB treatment, as a preventable, treatable, and curable disease. This situation was identified in both states, with high rates of lost to follow-up and death and distant from the goals set by the WHO for TB control by 2035¹⁶.

This study also allows us to understand the profile of cases affected by TB within prison units in the states of Rondônia and São Paulo, which is strongly associated with the structural deter-

Table 1. Analysis of social determinants of health, by the outcome of TB treatment among the population deprived of liberty in the state of Rondônia, Brazil, 2008 to 2017.

Variables		Favorable outcome n (%)*	Unfavorable outcome n (%)*	RR (95%CI)	
Gender	Male	513 (93.3)	155 (98.1)	3.09 (1.03-9.27)	
	Female	37 (6.7)	3 (1.9)	1	
Ethnicity/skin color	Black/brown	448 (81.8)	129 (81.6)	0.99 (0.70-1.42)	
	Other**	100 (18.2)	29 (18.4)	1	
Age group	≤ 30 years	373 (67.8)	109 (69.0)	1	
	> 30 years	177 (32.2)	49 (31.0)	0.96 (0.71-1.29)	
Schooling	≤ 7 years of study	361 (77.0)	113 (81.9)	1.27 (0.86-1.87)	
	> 7 years of study	108 (23.0)	25 (18.1)	1	
Comorbidities	AIDS	No	372 (96.4)	95 (87.2)	1
		Yes	14 (3.6)	14 (12.8)	2.46 (1.63-3.71)
	Diabetes	No	465 (97.5)	142 (99.3)	1
		Yes	12 (2.5)	1 (0.7)	0.33 (0.05-2.17)
	Alcohol abuse	No	420 (88.2)	115 (82.7)	1
		Yes	56 (11.8)	24 (17.3)	1.40 (0.96-2.02)
	Tobacco use	No	160 (68.4)	46 (71.9)	1
		Yes	74 (31.6)	18 (28.1)	0.88 (0.54-1.42)
	Use of illicit drugs	No	167 (72.0)	43 (68.3)	1
		Yes	65 (28.0)	20 (31.7)	1.15 (0.72-1.83)
	Mental disorder	No	476 (99.0)	143 (98.6)	1
		Yes	5 (1.0)	2 (1.4)	1.24 (0.38-4.03)
Treatment type	Self-administered	415 (78.7)	129 (86.0)	1.50 (0.99-2.29)	
	DOT	112 (21.3)	21 (14.0)	1	

* Invalid responses (blank/unknown) were not considered for the analyses; therefore, the value of "n" in some variables does not correspond to the total number of cases included in the study.

** Ethnicity/skin color white, yellow, and indigenous.

Source: Authors.

Table 2. Analysis of social determinants of health, by the outcome of TB treatment among the population deprived of liberty in the state of São Paulo, Brazil, 2008 to 2017.

Variables		Favorable outcome n (%)*	Unfavorable outcome n (%)*	RR (IC95%)	
Gender	Male	20.668 (98.2)	2.108 (94.7)	0.40 (0.34-0.46)	
	Female	389 (1.8)	119 (5.3)	1	
Ethnicity/skin color	Black/brown	9.690 (54.7)	1.010 (56.4)	1.06 (0.97-1.16)	
	Other**	8.012 (45.3)	780 (43.6)	1	
Age group	≤ 30 years	12.986 (61.7)	1.189 (53.4)	1	
	> 30 years	8.071 (38.3)	1.038 (46.6)	1.36 (1.26-1.47)	
Schooling	≤ 7 years of study	9.534 (60.8)	974 (63.0)	1.09 (0.98-1.20)	
	> 7 years of study	6.135 (39.2)	572 (37.0)	1	
Comorbidities	AIDS	No	19.814 (94.1)	1.798 (80.7)	1
		Yes	1.243 (5.9)	429 (19.3)	3.08 (2.81-3.38)
	Diabetes	No	20.860 (99.1)	2.189 (98.3)	1
		Yes	197 (0.9)	38 (1.7)	1.70 (1.27-2.28)
	Alcohol abuse	No	19.843 (94.2)	2.025 (90.9)	1
		Yes	1.214 (5.8)	202 (9.1)	1.54 (1.35-1.76)
	Tobacco use	No	18.509 (87.9)	2.010 (90.3)	1
		Yes	2.548 (12.1)	217 (9.7)	0.80 (0.70-0.92)
	Use of illicit drugs	No	17.751 (84.3)	1.851 (83.1)	1
		Yes	3.306 (15.7)	376 (16.9)	1.08 (0.97-1.20)
	Mental disorder	No	20.944 (99.5)	2.210 (99.2)	1
		Yes	113 (0.5)	17 (0.8)	1.37 (0.88-2.14)
Treatment type	Self-administered		1.064 (5.4)	275 (14.5)	2.55 (2.27-2.86)
	DOT		18.485 (94.6)	1.618 (85.5)	1

* Invalid responses (blank/unknown) were not considered for the analyses; therefore, the value of "n" in some variables does not correspond to the total number of cases included in the study.

** Ethnicity/skin color white, yellow, and indigenous.

Source: Authors.

minants of health inequalities since the disease manifested itself mainly in young, black/brown men with low schooling in a context marked by social and health inequalities.

The overrepresentation of males among PDL affected by TB can be primarily explained by the intense association between the "criminal world" and the structural determinants of health inequalities related to the culture and social values historically exercised by men. Also, within a structural context, as a complex, historical, and multifaceted social event, violence interacts with the SDHs, enhancing them in deprivation of liberty contexts, and contributing to situations of physical and emotional illness, increased suffering, distress, and unfavorable treatment outcomes, as found in Rondônia.

On the other hand, for the state of São Paulo, the male gender, a protective factor for the un-

favorable outcome of TB treatment, may reveal operational differences between prison units in different states and inequalities in the supply of actions according to the public to which they are intended. This hypothesis is, thus, raised since two studies conducted in Africa showed a lower supply of health actions for women in prison system^{25,26}, making them a vulnerable group to unfavorable treatment outcomes in the context in question.

Although race/skin color was not a risk factor for the unfavorable outcome within the prisons, the predominance of black and brown people in both states may be aligned with the significant increase of 14% in the proportion of blacks in the Brazilian penitentiary system in 15 years and a 19% decline in the proportion of whites. In this sense, we should mention the estimate that two in every three PDL are black²⁷.

Furthermore, we should underscore the structural determinants of health inequalities faced by black and brown people in everyday life, related to the socioeconomic and political context¹⁸, and the intermediate determinants, which include social stratification, material living conditions, schooling, housing, and work^{1,27}, since they strongly influence racial inequalities and structural racism in the prison system, concretely noted in the severity, differentiated treatment, and punitive sanctions.

Regarding age group and schooling, the study in Rondônia show results that contrast others showing that the profile of death and lost to follow-up of TB treatment among PDLs was associated with less educated young people^{28,29}. As for the state of São Paulo, the association between unfavorable outcomes and the age group over 30 coincides with that found in other studies carried out in the prison context, so that age over 35 was a predictive factor for unfavorable results of the TB treatment^{30,31}.

When observing the intermediate determinants of health related to living conditions and behavioral and biopsychosocial factors, we identified that AIDS was a risk factor for unfavorable treatment outcomes in both states. The evolution of HIV to AIDS today denotes weaknesses in health care systems, especially regarding the timely detection of cases of HIV infection and the provision and monitoring of the regular use of antiretroviral therapy (ART) in the prison context³². Thus, it is worth highlighting the need to improve access to diagnosis and monitoring of HIV/AIDS cases, not as a privilege or out of compassion, but as a constitutional right³³, since individuals in deprivation of liberty are under the State's tutelage.

In this regard, the study data include a period when ART implementation was not yet extended to all people living with HIV. This recommendation received the name of treatment as prevention was established in the country in 2013³⁴; that is, until that year, cases only started ART after the disease deteriorated, through laboratory and clinical indicators anchored in increased viral load, declining T-CD4 lymphocyte count, and the emergence of opportunistic diseases, such as TB, which consequently resulted in unfavorable treatment outcomes.

The state of São Paulo recorded an association of unfavorable outcomes with diabetes and alcohol abuse among PDLs. This relationship can be explained since such comorbidities considerably affect the conditions and quality of life of the

population, with physical and psychosocial impacts on individuals with TB³⁵, corroborating the results of studies that show that suffering from alcohol abuse and having other comorbidities such as diabetes in prison environments are associated with death and lost to follow-up of TB treatment among PDLs^{28,31}.

When addressing the use of substances other than alcohol, tobacco use was a protective factor for the unfavorable outcome in prisons in the state of São Paulo, in contrast to the findings of a study that showed the habit of smoking directly linked to radiological imaging of severe pulmonary TB cases, cases of recurrence, drug resistance, and treatment lost to follow-up³⁶. Regarding the use of illicit drugs, this was not identified as a risk factor for the unfavorable outcome of the cases, perhaps because this information is not being completed correctly in the notification form since such use is not allowed in the prison environment.

Mental disorders were not a significant factor in unfavorable TB treatment outcomes. However, a study identifies that PDLs have a high prevalence and a strong relationship with this condition, which can lead to worse outcomes in TB treatment and deteriorated mental disorders³⁷ and points to the need to review the care for individuals with mental disorders and the practice of leaving them in overcrowded cells, without psychological monitoring to guarantee their protection¹⁵.

Regarding the type of TB treatment, we identified that people whose self-administered treatment was indicated were 2.5 times more likely to have an unfavorable treatment outcome than those with an indication for DOT in prisons in the state of São Paulo. In this sense, DOT is widely recognized, recommended, and a potential tool for strengthening adherence to TB treatment by PDLs to reduce lost to follow-up and death rates in controlling the disease^{31,38}.

Furthermore, it is noteworthy that DOT was proportionally more performed in the state of São Paulo, which raises the hypothesis of the relationship between not using this type of treatment and therapeutic lost to follow-up since this outcome was about three times higher in Rondônia. This situation may reflect the prioritization of safety over health and the undervaluation of TB in these environments that should promote health as an inherent right, respecting the constitutional principle of universality, besides the low number of human resources for the operationalization of DOT in the prison system³⁹.

Among the limitations of this study, we should underscore a possible information bias resulting from the quality of the data used, notably for the state of Rondônia, whose information completeness was significant compared to the state of São Paulo. This fact highlights the importance of registration, proper completion of notification forms, and data feedback as an integral part of the work process of prison health teams to achieve quality data and health surveillance actions within Brazilian prisons, especially for the TB that is configured as an infectious disease and overlapping challenges for its combat and control. High data incompleteness facilitated univariate analysis, which did not allow controlling for possible confounding factors, another study limitation.

Final considerations

This study found that social and behavioral conditions and circumstances related to health actions and services influence the profile of PDLs with TB in the states of Rondônia and São Paulo, which are predominantly composed of young, black/brown men with low schooling levels.

Some SDH, such as alcohol abuse, diabetes, and self-administered treatment in the state of São Paulo, were identified as risk factors for the unfavorable outcome of TB treatment; the male gender in Rondônia, and AIDS in both states.

We hope the study will contribute with elements for qualifying care for people with TB in prison health units and planning actions that interfere with the SDH, such as risk stratification, care management for comorbidities, and the operationalization of DOT, to promote better conditions of incarceration, which in many cases violates fundamental rights of access to comprehensive health and the favorable outcome of TB cases.

In the social sphere, the study is expected to provide discussions about the current policy of penal execution, which, in practice, favors “mass incarceration”, the construction of new prisons, and the creation of more vacancies, to the detriment of strategies and public inclusion policies aimed at the social reintegration of individuals who have served their sentences, reinforcing their rights, the sense of citizenship, social belonging, and the reduction of social and health imbalances and inequalities.

Collaborations

MRL Ferreira contributed to the design, planning, analysis, and interpretation of the data. RLP Andrade and NH Orfão collaborated on data analysis and critical content review. All authors contributed to the review of the text and approved the final version of the manuscript.

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