Tuberculosis in prisons and factors associated with notification place in the state of São Paulo: a case-control study

Tuberculose nos presídios e fatores associados ao local de notificação no estado de São Paulo: um estudo caso-controle

Tuberculosis en las cárceles y factores asociados al lugar de notificación en el estado de São Paulo: un estudio de casos y controles

Nanci Michele Saita[1]
ORCID: https://orcid.org/0000-0002-0203-2765
University of São Paulo, Brazil
E-mail: nanci_michele@hotmail.com
Rubia Laine de Paula Andrade[1]
ORCID: https://orcid.org/0000-0001-5843-1733
University of São Paulo, Brazil
E-mail: rubia@eerp.usp.br
Pedro Augusto Bossonario[1]
ORCID: https://orcid.org/0000-0001-6287-174X
University of São Paulo, Brazil
E-mail: pedro.bossonario@usp.br
Mariana Gaspar Botelho Funari de Faria[1]
ORCID: https://orcid.org/0000-0002-5544-910X
University of São Paulo, Brazil
E-mail: rimagod@usp.br
Erika Aparecida Catoia[2]
ORCID: https://orcid.org/0000-0003-1687-5007
Department of Penitentiary Administration of São Paulo, Brazil
Department of Health of Ribeirão Preto, Brazil
E-mail: erikacatoia@hotmail.com
Melisane Regina Lima Ferreira[1]
ORCID: https://orcid.org/0000-0003-1694-5124
University of São Paulo, Brazil
E-mail: melisanerlf@usp.br
Aline Ale Beraldo[3]
ORCID: https://orcid.org/0000-0002-8491-4322
Department of Immunization and Communicable Diseases, Brazilian National Program for Immunization, Ministry of Health, Brazil
E-mail: li_aab@yahoo.com.br
Aline Aparecida Monroe[1]
ORCID: https://orcid.org/0000-0003-4073-2735
University of São Paulo, Brazil
E-mail: amonroe@eerp.usp.br

Abstract
Objective: to describe the sociodemographic, diagnostic, and clinical factors associated with tuberculosis notification place among persons deprived of liberty. Methods: this is a case-control study, with data collected from persons deprived of liberty diagnosed as new cases of tuberculosis, from 2015 to 2017, in the tuberculosis information system in the state of São Paulo. The cases comprised individuals notified outside the prison system, and the controls, those notified within the prison system, with a matching ratio equal to three. Exposure variables included: sociodemographic, diagnostic, and clinical data and were analyzed using frequency distribution and univariate analysis. Results: 5,764 cases of tuberculosis were reported in the prison system. It was evident that people of white and black race/color, who had the diagnosis during hospitalization, negative and not performed sputum culture, extrapulmonary and pulmonary+extra clinical form,

---
[1] Ribeirão Preto School of Nursing, University of São Paulo, Ribeirão Preto, São Paulo, Brazil

[2] Department of Penitentiary Administration of São Paulo, Ribeirão Preto, São Paulo, Brazil / Department of Health of Ribeirão Preto, Ribeirão Preto, São Paulo, Brazil

[3] Department of Immunization and Communicable Diseases, Brazilian National Program for Immunization, Ministry of Health. Brasília, Federal District, Brazil

diabetes mellitus and drug use are more likely to be notified outside the prison system. Conclusions: the study showed the potentialities of the prison system for detecting tuberculosis cases; however, it has limitations that have been transposed through the articulation with the services that make up the healthcare network.
Keywords: Tuberculosis; Prisons; Diagnostic; Notification.

Resumo
Objetivo: descrever os fatores sociodemográficos, diagnósticos e clínicos associados ao local de notificação da tuberculose entre pessoas privadas de liberdade. Métodos: estudo caso-controle, com dados coletados de pessoas privadas de liberdade diagnosticadas como casos novos de tuberculose no período de 2015 a 2017 no sistema de informação em tuberculose do estado de São Paulo. Os casos compreenderam os indivíduos notificados fora do sistema prisional e os controles aqueles notificados dentro do sistema prisional, com razão de pareamento igual a três. As variáveis de exposição incluíram: dados sociodemográficos, de diagnóstico e clínicos e foram analisadas por meio da distribuição de frequência e análise univariada. Resultados: foram notificados 5.764 casos de tuberculose no sistema prisional. Apresentam maior chance para notificação fora do sistema prisional as pessoas da raça/cor branca e preta, que tiveram o diagnóstico durante a internação, cultura de escarro negativo e não realizado, forma clínica extrapulmonar e pulmonar+extra, diabetes mellitus e uso de drogas. Conclusões: o estudo mostrou as potencialidades do sistema prisional para a detecção dos casos de tuberculose, no entanto, apresenta limitações que vem sendo transpostas por meio da articulação com os serviços que compõem a rede de atenção em saúde.
Palavras-chave: Tuberculose; Prisões; Diagnóstico; Notificação.

Resumen
Objetivo: describir los factores sociodemográficos, diagnósticos y clínicos asociados al lugar de notificación de tuberculosis entre personas privadas de libertad. Métodos: estudio de casos y controles, con datos recolectados de personas privadas de libertad diagnosticadas como nuevos casos de tuberculosis en el período de 2015 a 2017 en el sistema de información de tuberculosis del estado de São Paulo. Los casos comprendieron personas notificadas fuera del sistema penitenciario y controla a las notificadas dentro del sistema penitenciario, con una proporción de emparejamiento igual a tres. Las variables de exposición incluyeron: datos sociodemográficos, diagnósticos y clínicos y se analizaron mediante distribución de frecuencias y análisis univariante. Resultados: se notificaron 5.764 casos de tuberculosis en el sistema penitenciario. Las personas de raza / color blanca y negra, que tuvieron el diagnóstico durante la hospitalización, cultivo de esputo negativo y no realizado, forma clínica extrapulmonar y pulmonar + extra, diabetes mellitus y consumo de drogas tienen más probabilidades de ser notificadas fuera del sistema penitenciario. Conclusiones: el estudio mostró el potencial del sistema penitenciario para la detección de casos de tuberculosis, sin embargo, tiene limitaciones que se han superado a través de la articulación con los servicios que integran la red de atención de salud.
Palabras clave: Tuberculosis; Prisiones; Diagnóstico; Notificación.

1. Introduction

Worldwide, 10 million new tuberculosis (TB) cases were notified in 2018 (World Health Organization, 2019). Among the strategies launched to control the disease, actions are planned to be directed to populations living in vulnerable conditions (Bhatnagar et al., 2019), such as persons deprived of liberty (PDL), who are 34 times more likely to contract TB than the general population (Brazil, 2021; Pelissari & Diaz-Quijano, 2020).

Some factors attributable to the prison environment, such as overcrowding and inadequate ventilation (Baussano et al., 2010; Reyes & Coninx, 1997), infrastructure and prison time (Ali et al., 2015; Valença et al., 2015), segregation criteria (Stuckler et al., 2008), lack of training of professionals in prisons, insufficient laboratory diagnosis, poor drug supply, low priority of TB control in healthcare policies (Dara et al., 2015; Reyes & Coninx, 1997) explain the high incidence of the disease in such an environment. Moreover, aspects such as HIV infection (Coker et al., 2006), poor nutrition and hygiene (Baussano et al., 2010; Coker et al., 2006), drug addiction (Coker et al., 2006), late detection of cases, inadequate treatment and high turnover of PDL make it difficult to control TB in prisons (Baussano et al., 2010; Reyes & Coninx, 1997).

According to the Brazilian National Policy for Comprehensive Healthcare for the Prison Population (PNAISP), the Brazilian prison system must be able to offer comprehensive healthcare to PDL, anchored in the Unified Health System (SUS - *Sistema Único de Saúde*) principles and guidelines (Brazil, 2014). This ensures the ability to diagnose and notify diseases, such

as TB, within prisons (Brazil, 2014) or the referral of PDL in need of care to a specialized service in the healthcare network when it does not have sufficient resources for diagnosis and follow-up of cases (Mendes, 2015).

Upon diagnosis of a TB case, notification must take place regardless of the type of care service, in a timely manner, so that it is possible to characterize TB epidemiological profile and outline possible actions to prevent its transmission (Brazil, 2018).

Thus, a literature survey was carried out in the PubMed and Scielo databases on TB notification place cases. With the survey, 138 publications were found, after reviewing the articles, it was observed that none specified the notification place place; however, some publications presented strategies for the diagnosis of PDL within the prison system, such as tracking cases at the time of admission (Dhuria et al., 2016; Hatwiinda et al., 2018; Heuvelings et al., 2017; Kanyerere et al., 2012; Martín et al., 1994; Sanchez et al., 2005, 2009; Steiner et al., 2015; Winetsky et al., 2012), periodic screenings (Ayala et al., 2016; Hatwiinda et al., 2018; Mallick et al., 2017; Prasad et al., 2017; Ritter & Elger, 2012) or upon the identification of PDL with respiratory symptoms (Aerts et al., 2000; Guerra et al., 2019; Kalonji et al., 2016; Kanyerere et al., 2012; Mallick et al., 2017; Prasad et al., 2017; Rueda et al., 2015; Sanchez et al., 2009; Valença et al., 2016; Vieira et al., 2010).

TB in prisons is a challenge for controlling the disease in Brazil, since, in recent years (2010 to 2019), the proportion of new cases diagnosed in the PDL has almost doubled, going from 6.4% in 2010 to 11.1% in 2019, representing the highest proportion of new cases among the populations most vulnerable to TB illness (Brazil, 2020).

Therefore, there is a need for studies to deal with the disease that prioritize the identification of characteristics associated with notification place of PDL cases, which may reveal gaps and strategies for a timely diagnosis of this key population for disease control. Thus, this study intends to identify the sociodemographic, diagnostic and clinical factors associated with TB notification place of the studied cases.

2. Methodology

This is a case-control study, carried out in the state of São Paulo, which has the largest prison population in the country (Brazil, 2017), distributed in five regional coordinators, with 168 prison units until 2018, divided into Penitentiaries, Center of Penitentiary Progression, Provisional Detention Center, Resocialization Centers, Differentiated Disciplinary Regime Unit and Custody Hospitals (Governo do Estado de São Paulo, 2018).

TB cases among PDL are generally diagnosed by prisons or by the healthcare network, which is comprised of primary healthcare, mixed services and emergency care, and emergency services, specialized clinics and hospitals. Generally, whoever gives the diagnosis of the case, proceeds with the notification to the State of São Paulo Control System for Patients with Tuberculosis (TB-WEB).

For this study, all new TB cases (incidents) in PDL notified outside the São Paulo prison system were defined as cases. For the selection of controls, new TB cases reported within the prison system studied were considered. As inclusion criterion for both case and control groups, PDL aged 18 years or over, diagnosed and notified in the TB-WEB in the period from 2015 to 2017, were considered. Cases of recurrence, re-entry after treatment default, change of diagnosis and transfer to another state were excluded. It is noteworthy that there was no concern with matching, as all cases and controls were included, thus resulting in a matching ratio equal to three, i.e., three controls for each case (5,764/1,795).

The exposure variables used in the study were collected from the TB-WEB and comprises sociodemographic variables (gender, age group, race/color, education), case diagnosis (place of diagnosis, sputum smear microscopy results, sputum culture and results of X-ray) and clinical variables (clinical form, comorbidities, HIV infection, diabetes mellitus, alcoholism, mental disorder, drug use and smoking).

In order to ensure data comparability, data were collected concomitantly for cases and controls and from the same source of information.

Data were analyzed through frequency distribution and univariate analysis, using the Epitools library of the program R/RStudio, version 1.2.5033. For the univariate analysis, the risk of occurrence of a dependent variable (notification place - outside prison), according to exposure variables, was established by Odds Ration and their respective confidence intervals, adopting a significance level of 5%.

This study was approved by the Research Ethics Committee of the University of São Paulo (Protocol 79872217.7.3001.5563), ensuring the confidentiality of information and meeting the recommendations and ethical precepts contained in resolution 466/112 of the Brazilian National Health Council (*Conselho Nacional de Saúde*).

3. Results

From 2015 to 2017, 9,778 TB cases were notified among the PDL of the state of São Paulo. We excluded 1,558 cases of recurrence, 568 re-entry after treatment default, 48 changes in diagnosis, 19 transfers to another state, 26 children under 18 years of age, resulting in 7,559 study participants. Of these, 5,764 were reported in the prison system.

Of the PDL notified in the prison system, most were male (98.4%), aged between 26 and 35 years (44.2%), brown race/color (48.9%) and schooling between 4 and 7 years of study (48.4%). Among the 1,795 cases diagnosed outside the prison system, the most prominent were males (98%), aged between 26 and 35 years (44.4%), white race/color (47.7%) and schooling between 4 to 7 years of study (49.9%). Evidence was identified that white and black race/color constituted a risk factor for people who were notified outside the prison system when compared to people with brown race/color (Table 1).

Table 1. Sociodemographic characteristics of tuberculosis cases in prisons according to notification place, São Paulo, 2015-2017

Variable	Response category	Notification place		OR (95% CI)
		Prison system n (%)	Out of the Prison System n (%)	
Sex	Male	5,670(98.4)	1,759(98.0)	1
	Female	94(1.6)	36(2.0)	1.23(0.84-1.82)
Age group	From 18 to 25 years	2,159(37.5)	672(37.5)	1
	From 26 to 35 years	2,544(44.2)	795(44.4)	1.00(0.89-1.13)
	From 36 to 55 years	991(17.2)	309(17.3)	1.00(0.86-1.17)
	From 56 to 84 years	59(10.3)	14(0.8)	0.76(0.42-1.37)
Race/color	Brown	2,524(48.9)	671(40.3)	1
	White	2,089(40.4)	794(47.7)	**1.43(1.27-1.61)**
	Black	536(10.4)	195(11.7)	**1.37(1.14-1.65)**
	Yellow/Indigenous	17(0.3)	5(0.3)	1.10(0.41-3.01)
Schooling	None	34(0.9)	16(1.1)	1
	1 to 3 years	236(5.7)	149(10.5)	1.46(0.78-2.72)
	4 to 7 years	1,89(48.4)	706(49.9)	0.82(0.45-1.48)
	8 to 11 years	1,703(41.5)	499(35.2)	0.68(0.37-1.23)
	12 years and more	144(3.5)	46(3.3)	0.74(0.38-1.45)

Source: Authors.

Regarding the diagnosis characteristics, the majority (54.3%) occurred after spontaneous outpatient demand in both groups. The results of sputum smear microscopy and sputum cultures were mostly positive among those notified by the prison system (55.6% and 69.1%, respectively), and among those notified outside (54.9% and 61.9%, respectively). X-ray examinations were not performed in 81.9% of cases reported by the prison system and in 68.8% of cases reported outside. It was found that

cases with a diagnosis made on admission and a negative or non-performed sputum culture were risk factors for notification of cases outside the prison system, when compared, respectively, to people who were diagnosed in the outpatient consultation and who had a positive sputum culture. People with normal and not performed X-rays were reported more within the prison system compared to people with X-rays suggestive of TB (Table 2).

Table 2. Place of diagnosis and results of tests performed for the diagnosis of tuberculosis cases in prisons according to notification place, São Paulo, 2015-2017.

| Variable | Response category | Notification place | | OR (95% CI) |
		Prison System n(%)	Out of the Prison System n(%)	
Diagnosis place	Outpatient spontaneous demand	2,859(54.3)	892(54.3)	1
	Active search in the institution	1,656(31.5)	523(31.9)	1.01(0.89-1.15)
	Emergency	295(5.6)	84(5.1)	0.91(0.71-1.18)
	Contact investigation	281(5.3)	74(4.5)	0.84(0.65-1.10)
	Inpatient diagnosis	143(2.7)	61(3.7)	**1.37(1.01-1.86)**
	Active search in the community	28(0.5)	8(0.5)	0.92(0.42-2.02)
	Diagnosis after death	6(0.1)	-	-
Diagnostic sputum smear microscopy	Positive	3,190(55.6)	981(54.9)	1
	Negative	1,161(20.3)	400(22.4)	1.12(0.98-1.28)
	Not perfomed	1,366(23.8)	406(22.7)	0.97(0.85-1.10)
	Progress	19(0.3)	1(0.0)	0.17(0.02-1.28)
Sputum culture	Positive	3,857(69.1)	1.088(61.9)	1
	Negative	641(11.5)	298(16.9)	**1.65(1.41-1.92)**
	Not perfomed	1,022(18.3)	361(20.5)	**1.25(1.09-1.44)**
	Progress	62(1.1)	12(0.7)	0.69(0.37-1.28)
X-ray	Suspected tuberculosis	789(15.5)	443(28.6)	1
	Normal	109(2.1)	28(1.8)	**0.46(0.30-0.70)**
	Other pathology	23(0.5)	12(0.8)	0.93(0.46-1.89)
	Not performed	4,177(81.9)	1.067(68.8)	**0.45(0.40-0.52)**

Source: Authors.

As for cases reported in the prison system, 97.9% presented pulmonary TB, 55% had other comorbidities, 4.3% had HIV co-infection, 0.6% diabetes, 7.2% alcoholism, 0.4% mental disorder, 17.4% were drug users and 24.3% were smokers. Cases reported outside the prison system had a similar clinical profile, except for drug use, which was higher (25.9%). It was found that the extrapulmonary and pulmonary+extra clinical forms, the presence of diabetes mellitus and drug use were risk factors for reporting cases outside the prison system, when compared, respectively, to the pulmonary clinical form, not having diabetes mellitus and not be a drug user (Table 3).

Table 3. Clinical characteristics of tuberculosis cases in prisons according to notification place, São Paulo, 2015-2017

Variable	Response category	Notification place		OR (95%CI)
		Prison System n(%)	Out of the Prison System n(%)	
Clinical form	Pulmonary	5,641(97.9)	1,688(94.1)	1
	Extrapulmonary	100(1.7)	85(4.7)	**2.84(2.12-3.81)**
	Pulmonary and Extrapulmonary	23(0.4)	22(1.2)	**3,20(1.78-5.75)**
Comorbidities	Yes	3170(55.0)	982(54.7)	0,99(0.89-1.10)
	No	2,594(45.0)	813(45.3)	1
HIV infection	Yes	245(4.3)	96(5.4)	1,27(0.99-1.62)
	No	5,519(95.7)	1,699(94.6)	1
Diabetes mellitus	Yes	35(0.6)	22(1.2)	**2.03(1.19-3.47)**
	No	5,729(99.4)	1,773(98.8)	1
Alcoholism	Yes	412(7.2)	143(8.0)	1.,12(0.92-1.37)
	No	5352(92.8)	1,652(92.0)	1
Mental disorder	Yes	24(0.4)	11(0.6)	1,47(0.72-3.02)
	No	5.740(99.6)	1,784(99.4)	1
Drug use	Yes	1.002(17.4)	465(25.9)	**1,66(1.47-1.88)**
	No	4.762(82.6)	1.330(74.1)	1
Smoking	Yes	1.399(24.3)	459(25.6)	1,07(0.95-1.21)
	No	4.365(75.7)	1,336(74.4)	1

Source: Authors.

4. Discussion

In the study, sociodemographic data indicated the predominance of TB in males, young adults, brown/black and those with incomplete elementary education. This result is consistent with the sociodemographic profile of the Brazilian prison population, which presents 91.6% of male PDL, 55% aged between 18 and 29 years old, 64% brown/black (Brazilian Institute of Geography and Statistics, 2015) and 61% illiterate or with low level of schooling (Brazil, 2017).

Also, in relation to sociodemographic data, it was identified that people of black and white race/color are more likely to be notified outside the prison system than brown people, and it is difficult to specify a reason for this occurrence. However, the diversity and context of ethnic-racial vulnerability in the Brazilian scenario reflect complex social processes permeated by precarious living and health conditions, as well as by violence and criminality (Monteiro & Cardoso, 2010). As for the smaller percentage of white prisoners, this result can be representative since they are not the majority in the prison environment.

Moreover, in prisons, diagnosis during spontaneous outpatient demands predominated, followed by diagnosis based on the active search for TB cases in this context. A study in the Indian prison system showed that the implementation of an improved case-finding strategy with access to diagnostic services was associated with increased testing and TB case detection rates (Mallick et al., 2017). In Brazil, 12.9% of PDL had a confirmed diagnosis of TB during active and passive case finding, of which 86.1% had microbiological confirmation (Valença et al., 2016). In the present study, it is worth highlighting the presence of cases diagnosed outside the prison system, with an emphasis on hospital units, i.e., characterizing a possible delay in diagnosis and/or worsening of TB cases among PDL.

In the characteristics related to diagnosis, a high percentage of cases had negative or not performed sputum smear microscopy. It is known that this diagnostic resource is not the test of choice for PDL in places where the rapid molecular test for TB is available (GeneXpert MTB/RIF), since sputum smear microscopy has less sensitivity compared to the rapid molecular test, and does not identify drug resistance. During the study period, the state of São Paulo was in the process of implementing the rapid molecular test for TB, which could also have resulted in not prioritizing the performance of sputum smear microscopy in determining the diagnosis of TB in prison units. As for smears not performed, possible operational and agreement challenges

within the healthcare network deserve to be investigated to understand the established local dynamics relevant to the flow of collection, storage and shipment of samples to reference laboratories. Considering the follow-up sputum smear microscopy, a study carried out in Santa Catarina showed that 62.0% of such exam into PDL had conversion only in the fourth month of treatment, which reinforces the importance of performing the exam due to TB transmission chain maintenance for many months in prisons (Medeiros et al., 2018).

Negative and not performed sputum culture consisted of risk factors for notification of TB outside the prison system. For PDL who were diagnosed by sputum smear microscopy, the performance of sputum culture with sensitivity test was a national recommendation during the study period, as it allows the identification of the species and drug sensitivity, being important tests for both the diagnosis of sensitive TB, as for cases of resistance.

Another important factor was chest X-ray screening, considered an effective and cost-effective intervention in vulnerable populations (Heuvelings et al., 2017), mainly in situations where empirical treatment is indicated. This diagnostic resource was more performed in cases reported outside the prison system, requiring displacement of PDL, which involves a complex mobilization of resources to reconcile legal and health priorities in the provision of vehicles and escorts (Ferreira et al., 2019). In El Salvador's prison system, there was a significant increase in the notification of cases, which was provided by the search for TB cases and the offer of rapid molecular TB testing, together with mobile X-ray (Ayala et al., 2016).

As for clinical factors, it was found that notification outside prison is associated with extrapulmonary TB, which characterizes greater difficulty in defining cases, requiring more complex diagnostic methods than sputum smear microscopy and chest X-ray, and that are not available in the prison system. It is noteworthy that some conditions such as diabetes mellitus (Ferrara et al., 2012) and drug use (O'Grady et al., 2011), which can compromise immune status, make the diagnosis of people with TB difficult; thus, the rear of specialized services within the healthcare network was essential for such a diagnosis.

Another clinical characteristic such as HIV infection was not a determining factor for notification outside the prison system. This result may represent a gain in relation to the use of the Gene Xpert test in people living with HIV, whose paucibacillary characteristic would constitute a limitation to the use of sputum smear microscopy, which requires a large amount of bacilli in sputum samples to perform the test. However, the use of the Gene Xpert test was not analyzed due to incompleteness of its variable, requiring further clarification in this regard.

As for other comorbidities, alcoholism and mental disorder occurred infrequently among the cases studied and were not associated with the diagnosis outside prisons. Regarding smoking, a greater association between people who smoke and the clinical pulmonary form of TB is described in literature (Aryanpur et al., 2016), which is easier to diagnose in the prison environment. This facility may also occur due to a greater finding of pulmonary cavitation on chest radiographs among smokers (Mahishale et al., 2015; Rathee et al., 2016).

Based on the above, the potential of the prison system for the diagnosis of TB cases is verified in light of some sociodemographic and clinical characteristics of cases among PDL. However, it is worth noting that its limitations regarding the detection of cases have been overcome through articulation with the services that make up the community's healthcare network.

Among the study limitations, there is a possible information bias since the data were collected from secondary sources.

5. Conclusion

Among the characteristics associated with notification of TB outside the prison system, people of white and black race/color, diagnosis on admission, negative and not performed sputum culture, extrapulmonary or pulmonary+extra TB, diabetes mellitus and drug use were identified. It was found that most people diagnosed outside the prison system underwent X-rays in the diagnostic process and had less normal image on examination. These characteristics complement each other in directing strategic actions aimed at TB prevention, diagnosis and treatment in prisons, showing the importance of prison

healthcare capable of diagnosing and starting treatment for TB in a timely and opportune place for PDL, which is a challenge in controlling the disease, given the growth in TB cases in this population. Furthermore, the study's findings reinforce the relevance in terms of definition and agreements between specialized and laboratory services within the healthcare network for rearguard purposes in diagnosing and sharing clinical-therapeutic commitments and responsibilities for TB management among PDL.

Acknowledgments

References

Aerts, A., Habouzit, M., Mschiladze, L., Malakmadze, N., Sadradze, N., Menteshashvili, O., Portaels, F., & Sudre, P. (2000). Pulmonary tuberculosis in prisons of the ex-USSR state Georgia: results of a nation-wide prevalence survey among sentenced inmates. *The International Journal of Tuberculosis and Lung Disease*, *4*(12), 1104–1110. http://www.ncbi.nlm.nih.gov/pubmed/11144451.

Ali, S., Haileamlak, A., Wieser, A., Pritsch, M., Heinrich, N., Loscher, T., Hoelscher, M., & Rachow, A. (2015). Prevalence of Pulmonary Tuberculosis among Prison Inmates in Ethiopia, a Cross-Sectional Study. *PLOS ONE*, *10*(12), e0144040. 10.1371/journal.pone.0144040.

Aryanpur, M., Hosseini, M., Masjedi, M. R., Mortaz, E., Tabarsi, P., Soori, H., Emami, H., Heidari, G., Dizagie, M. K., & Baikpour, M. (2016). A randomized controlled trial of smoking cessation methods in patients newly-diagnosed with pulmonary tuberculosis. *BMC Infectious Diseases*, *16*(1), 369. 10.1186/s12879-016-1727-4.

Ayala, G., Garay, J., Aragon, M., Decroo, T., & Zachariah, R. (2016). Trends in tuberculosis notification and treatment outcomes in prisons: A country-wide assessment in El Salvador from 2009-2014. *Revista Panamericana de Salud Publica*, *39*(1), 38–43.

Baussano, I., Williams, B. G., Nunn, P., Beggiato, M., Fedeli, U., & Scano, F. (2010). Tuberculosis Incidence in Prisons: A Systematic Review. *PLoS Medicine*, *7*(12), e1000381. 10.1371/journal.pmed.1000381.

Bhatnagar, T., Ralte, M., Ralte, L., Chawnglungmuana, Sundaramoorthy, L., & Chhakchhuak, L. (2019). Intensified tuberculosis and HIV surveillance in a prison in Northeast India: Implementation research. *PLoS ONE*, *14*(7), e0219988. 10.1371/journal.pone.0219988.

Brasil. Ministério da Saúde. (2014). *Portaria Interministerial nº1, de 2 de janeiro de 2014 institui a Política Nacional de Atenção Integral à Saúde das Pessoas Privadas de Liberdade no Sistema Prisional (PNAISP) no âmbito do Sistema Único de Saúde (SUS)*. Diário Oficial da União, Brasília, 03 jan. 2014. Seção 1, p.18-21.

Brasil. Ministério da Justiça. Departamento Penitenciário Nacional. (2017). *Levantamento Nacional de Informações Penitenciárias: atualização - junho de 2016*. Ministério da Justiça. http://www.depen.gov.br/DEPEN/noticias-1/noticias/infopen-levantamento-nacional-de-informacoes-penitenciarias-2016/relatorio_2016_22111.pdf.

Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. (2018). *Boletim Epidemiológico. Implantação do Plano Nacional pelo Fim da Tuberculose como Problema de Saúde Pública no Brasil: primeiros passos rumo ao alcance das metas*. Ministério da Saúde.

Brasil. Ministério da Saúde; Secretaria de Vigilância em Saúde; Departamento de Doenças de Condições Crônicas e Infecções Sexualmente Transmissíveis. (2020). *Boletim epidemiológico tuberculose 2020*. Ministério da Saúde. http://www.aids.gov.br/pt-br/pub/2020/boletim-epidemiologico-de-turbeculose-2020.

Brasil. Ministério da Justiça e Segurança Pública. Fundação Oswaldo Cruz. Programa Nacional de Controle da Tuberculose. (2021). *Prisões livres de TB*. Brasília: Ministério da Justiça e Segurança Pública. https://www.prisoeslivresdetb.com.br/tb-nas-prisoes.

Coker, R., McKee, M., Atun, R., Dimitrova, B., Dodonova, E., Kuznetsov, S., & Drobniewski, F. (2006). Risk factors for pulmonary tuberculosis in Russia: Case-control study. *British Medical Journal*, *332*(7533), 85–87. 10.1136/bmj.38684.687940.80.

Dara, M., Acosta, C. D., Melchers, N. V. S. V., Al-Darraji, H. A. A., Chorgoliani, D., Reyes, H., Centis, R., Sotgiu, G., D'Ambrosio, L., Chadha, S. S., & Migliori, G. B. (2015). Tuberculosis control in prisons: Current situation and research gaps. *International Journal of Infectious Diseases*, 32, 111–117. 10.1016/j.ijid.2014.12.029.

Dhuria, M., Sharma, N., Chopra, K. K., & Chandra, S. (2016). Universal access to DOTS in Delhi Prisons: Where do we stand? *Indian Journal of Tuberculosis*, *63*(1), 39–43. 10.1016/j.ijtb.2016.01.005.

Ferrara, G., Murray, M., Winthrop, K., Centis, R., Sotgiu, G., Migliori, G. B., Maeurer, M., & Zumla, A. (2012). Risk factors associated with pulmonary tuberculosis. *Current Opinion in Pulmonary Medicine*, *18*(3), 233–240. 10.1097/MCP.0b013e328351f9d6.

Ferreira, M. R., Bonfim, R. O., Siqueira, T. C., Andrade, R. L. de P., Monroe, A. A., Villa, T. C., & Orfão, N. H. (2019). Tuberculosis in prison and aspects associated with the diagnosis site. *The Journal of Infection in Developing Countries*, *13*(11), 968–977. 10.3855/jidc.11522.

Governo do Estado de São Paulo. Secretaria de Administração Penitenciária (SAP). (2018). *Conheça a SAP: história da SAP*. Secretaria de Administração Penitenciária. http://www.sap.sp.gov.br/dir-coo.html.

Guerra, J., Mogollón, D., González, D., Sanchez, R., Rueda, Z. V., Parra-López, C. A., & Murcia, M. I. (2019). Active and latent tuberculosis among inmates in

La Esperanza prison in Guaduas, Colombia. *PLOS ONE*, *14*(1), e0209895. 10.1371/journal.pone.0209895.

Hatwiinda, S., Topp, S. M., Siyambango, M., Harris, J. B., Maggard, K. R., Chileshe, C., Kapata, N., Reid, S. E., & Henostroza, G. (2018). Poor continuity of care for TB diagnosis and treatment in Zambian Prisons: a situation analysis. *Tropical Medicine & International Health*, *23*(2), 243–250. 10.1111/tmi.13024.

Heuvelings, C. C., de Vries, S. G., & Grobusch, M. P. (2017). Tackling TB in low-incidence countries: improving diagnosis and management in vulnerable populations. *International Journal of Infectious Diseases*, *56*, 77–80. 10.1016/j.ijid.2016.12.025.

Instituto Brasileiro de Geografia e Estatística (IBGE). (2015). *Pesquisa nacional por amostra em domicílios.* Instituto Brasileiro de Geografia e Estatística. https://sidra.ibge.gov.br/pesquisa/pnad.

Kalonji, G. M., De Connick, G., Okenge Ngongo, L., Kazumba Nsaka, D., Kabengele, T., Tshimungu Kandolo, F., Ilunga-Ilunga, F., Adelin, A., & Giet, D. (2016). Prevalence of tuberculosis and associated risk factors in the Central Prison of Mbuji-Mayi, Democratic Republic of Congo. *Tropical Medicine and Health*, *44*(1), 30. 10.1186/s41182-016-0030-9.

Kanyerere, H. S., Banda, R. P., Gausi, F., Salaniponi, F. M., Harries, A. D., Mpunga, J., Banda, H. M., Munthali, C., & Ndindi, H. (2012). Surveillance of tuberculosis in Malawian prisons. *Public Health Action*, *2*(1), 10–14. 10.5588/pha.11.0022.

Mahishale, V., Patil, B., Lolly, M., Eti, A., & Khan, S. (2015). Prevalence of Smoking and Its Impact on Treatment Outcomes in Newly Diagnosed Pulmonary Tuberculosis Patients: A Hospital-Based Prospective Study. *Chonnam Medical Journal*, *51*(2), 86. 10.4068/cmj.2015.51.2.86.

Mallick, G., Shewade, H. D., Agrawal, T. K., Kumar, A. M. V., & Chadha, S. S. (2017). Enhanced tuberculosis case finding through advocacy and sensitisation meetings in prisons of Central India. *Public Health Action*, *7*(1), 67–70. 10.5588/pha.16.0109.

Martín, V., Gonzalez, P., Caylá, J. A., Mirabent, J., Cañellas, J., Pina, J. M., & Miret, P. (1994). Case-finding of pulmonary tuberculosis on admission to a penitentiary centre. *Tubercle and Lung Disease*, *75*(1), 49–53. 10.1016/0962-8479(94)90102-3.

Medeiros, T. F., Nogueira, C. L., Prim, R. I., Scheffer, M. C., Alves, E. V., Rovaris, D. B., Zozio, T., Rastogi, N., & Bazzo, M. L. (2018). Molecular epidemiology of Mycobacterium tuberculosis strains from prison populations in Santa Catarina, Southern Brazil. *Infection, Genetics and Evolution*, *58*, 34–39. 10.1016/j.meegid.2017.12.010.

Mendes, E. V. (2015). *A construção social da atenção primária à saúde.* Conselho Nacional de Secretários de Saúde CONASS.

Monteiro, F. M., & Cardoso, G. R. (2013). A seletividade do sistema prisional brasileiro e o perfil da população carcerária: um debate oportuno. *Civitas Revista de Ciências Sociais,* 13(1), 93-117. 10.15448/1984-7289.2013.1.12592.

O'Grady, J., Hoelscher, M., Atun, R., Bates, M., Mwaba, P., Kapata, N., Ferrara, G., Maeurer, M., & Zumla, A. (2011). Tuberculosis in prisons in sub-Saharan Africa – the need for improved health services, surveillance and control. *Tuberculosis*, *91*(2), 173–178. 10.1016/j.tube.2010.12.002.

Pelissari, D. M., & Diaz-Quijano, F. A. (2020). Impact of incarceration on tuberculosis incidence and its interaction with income distribution inequality in Brazil. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *114*(1), 23–30. 10.1093/trstmh/trz088.

Prasad, B. M., Thapa, B., Chadha, S. S., Das, A., Babu, E. R., Mohanty, S., Pandurangan, S., & Tonsing, J. (2017). Status of Tuberculosis services in Indian Prisons. *International Journal of Infectious Diseases*, *56*, 117–121. 10.1016/j.ijid.2017.01.035.

Rathee, D., Arora, P., Meena, M., Sarin, R., Chakraborty, P., Jaiswal, A., & Goyal, M. (2016). Comparative study of clinico-bacterio-radiological profile and treatment outcome of smokers and nonsmokers suffering from pulmonary tuberculosis. *Lung India*, *33*(5), 507. 10.4103/0970-2113.188970.

Reyes, H., & Coninx, R. (1997). Pitfalls of tuberculosis programmes in prisons. *BMJ*, *315*(7120), 1447–1450. 10.1136/bmj.315.7120.1447.

Ritter, C., & Elger, B. S. (2012). Prevalence of positive tuberculosis skin tests during 5 years of screening in a Swiss remand prison. *The International Journal of Tuberculosis and Lung Disease*, *16*(1), 65–69. 10.5588/ijtld.11.0159.

Rueda, Z. V., López, L., Marín, D., Vélez, L. A., & Arbeláez, M. P. (2015). Sputum induction is a safe procedure to use in prisoners and MGIT is the best culture method to diagnose tuberculosis in prisons: a cohort study. *International Journal of Infectious Diseases*, *33*, 82–88. 10.1016/j.ijid.2015.01.004.

Sanchez, A., Gerhardt, G., Natal, S., Capone, D., Espinola, A., Costa, W., Pires, J., Barreto, A., Biondi, E., & Larouzé, B. (2005). Prevalence of pulmonary tuberculosis and comparative evaluation of screening strategies in a Brazilian prison. *The International Journal of Tuberculosis and Lung Disease*, *9*(6), 633–639.

Sanchez, A., Larouzé, B., Espinola, A. B., Pires, J., Capone, D., Gerhardt, G., Cesconi, V., Procopio, M. J., Hijjar, M., & Massari, V. (2009). Screening for tuberculosis on admission to highly endemic prisons? The case of Rio de Janeiro State prisons. *The International Journal of Tuberculosis and Lung Disease*, *13*(10), 1247–1252.

Steiner, A., Mangu, C., van den Hombergh, J., van Deutekom, H., van Ginneken, B., Clowes, P., Mhimbira, F., Mfinanga, S., Rachow, A., Reither, K., & Hoelscher, M. (2015). Screening for pulmonary tuberculosis in a Tanzanian prison and computer-aided interpretation of chest X-rays. *Public Health Action*, *5*(4), 249–254. 10.5588/pha.15.0037.

Stuckler, D., Basu, S., Mckee, M., & King, L. (2008). Mass incarceration can explain population increases in TB and multidrug-resistant TB in European and central Asian countries. *Proceedings of the Nationall Academy of Science of the United States of America*, 105(36), 13280–13285. 10.1073/pnas.0801200105.

Valença, M. S., Scaini, J. L. R., Abileira, F. S., Gonçalves, C. V., von Groll, A., & Silva, P. E. A. (2015). Prevalence of tuberculosis in prisons: risk factors and molecular epidemiology. *The International Journal of Tuberculosis and Lung Disease*, *19*(10), 1182–1187. 10.5588/ijtld.15.0126.

Valença, M. S., Cezar-Vaz, M. R., Brum, C. B., & Silva, P. E. A. (2016). O processo de detecção e tratamento de casos de tuberculose em um presídio. *Ciência & Saúde Coletiva*, *21*(7), 2111–2122. 10.1590/1413-81232015217.13822015.

Vieira, A. A., Ribeiro, S. A., Siqueira, A. M., Galesi, V. M. N., Santos, L. A. R., & Golub, J. E. (2010). Prevalence of patients with respiratory symptoms through active case finding and diagnosis of pulmonary tuberculosis among prisoners and related predictors in a jail in the city of Carapicuíba, Brazil. *Revista Brasileira de Epidemiologia*, *13*(4), 641–650. 10.1590/S1415-790X2010000400009.

Winetsky, D. E., Negoescu, D. M., DeMarchis, E. H., Almukhamedova, O., Dooronbekova, A., Pulatov, D., Vezhnina, N., Owens, D. K., & Goldhaber-Fiebert, J. D. (2012). Screening and Rapid Molecular Diagnosis of Tuberculosis in Prisons in Russia and Eastern Europe: A Cost-Effectiveness Analysis. *PLoS Medicine*, *9*(11), e1001348. 10.1371/journal.pmed.1001348.

World Health Organization. (2019). *Global Tuberculosis Report 2019*. WHO. https://apps.who.int/iris/bitstream/handle/10665/3 29368/9789241565714-eng.pdf?ua=1.