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Tuberculosis control in prisons, from research to action: the Rio de Janeiro, Brazil, experience

Alexandra Sánchez [1]
Bernard Larouzé [2]

Abstract *The high tuberculosis (TB) rates observed in the Brazilian prison population highlights the need for more efficient TB control measures in this population, especially in the state of Rio de Janeiro where detection rates are 30 times higher than in the general population. We present results of epidemiological, biomathematics modelling, molecular biology, psychosocological, architectural and juridical studies carried out in this state in order to assess the situation and to develop TB control strategies adapted to the specificities of the prison context. The implementation of these strategies implies to take into account the day-to-day realty of prison life and to turn more effective the supervision of the prison health system by instances in charge of monitoring the fulfillment of sentences, so as to guarantee access of prisoners to health in conformity with international and national laws.*

Key words *Tuberculosis, Control, Prison, Public Health, Brazil*

[1] Centro de Referência Professor Hélio Fraga, Escola Nacional de Saúde Pública Sérgio Arouca, Fundação Oswaldo Cruz. R. Leopoldo Bulhões 1480, Manguinhos. 21041-210 Rio de Janeiro RJ Brasil. alexandra.sanchez@ensp.fiocruz.br
[2] Sorbonne Universités, UMPC Univ Paris 6, INSERM, IPLESP UMRS 1136, Equipe de Recherche en Epidémiologie Sociale. Paris France.

Introduction

Incarcerating people deprived of liberty (PDL), in a country such as Brazil with high or median tuberculosis (TB) endemicity, in overcrowded and poorly ventilated environments, has as its immediate consequence the increase of transmission and a hyper endemicity in this setting[1]. This is a risk not only for PDLs, but also for their families, professionals who carry out their duties in prisons, and for the communities to which the PDLs will return after being freed[2]. This is the case of prisons in Rio de Janeiro (RJ), the state where TB detection rates cases are amongst the highest in the country, as much in terms of the general population as the prison population.

This situation affects around 39,000 PDLs housed in 50 prison units across the state. The rate of incarceration (239/100,000) is not the highest in the country, but the median rate of occupation, which is 140%, varies according to the prison, potentially rising to 200% in some instances. Overcrowding is the result of progressive growth, which accelerated starting in 2010, with the number of incarcerated people increasing 85% over the last ten years. At the same time, the increase in the number of places was only around 20%[3]. The majority of state prisons are antiquated and run down, with collective cells holding up to more than 100 PDLs, in a poorly ventilated environment with little natural light. One of the particularities of the penitentiary system in the state of RJ is that 47% of the prison units are grouped in the Gericinó Complex, located on the outskirts of the capital, which houses 57.3% of the state's PDLs.

To respond to the health care needs of the PDLs, each prison unit contains a health care unit and, in 2010, the prison management created an Emergency Care Unit in the prison complex, replacing the General Penitentiary Hospital. The Penal Sanatorium (PS), also located in this complex, undertakes TB control measures, including care of patients. The PS includes a mobile TB diagnosis and treatment service, as well as 104 hospital beds (including seven isolation beds for cases of anti-TB drug resistance), a radiology service, a microbiology laboratory with equipment to undertake bacilloscopy, BK cultures, and drug sensitivity testing (DST).

In the state of RJ, PDLs, of which around 50% are awaiting sentencing, have a profile similar to that of the incarcerated population throughout the country[3]. It is a young, predominately male population, with little education, living principally in poorer communities or the slums of the state's larger cities, particularly in the city of Rio de Janeiro and its metropolitan region[4]. Beyond this, 40.7% of the PDLs report previous incarceration and 9.6% have a history of TB[4,5]. Amongst these PDLs, the rate of TB detection is particularly high, around 30 times higher than the state's general population[6].

From 1962 to 2001, the TB control measures carried out were centered in the PS, being limited to case-finding in response to spontaneous attendance and hospitalization and supervised treatment in the PS for a period of 2 to 3 months. After this period, patients returned to their prison of origin, where interruption of the treatment was common. As Graphs 1 and 2 show, the high annual detection rates remained stable, around 1,600/100,000, and rates of cure did not exceed 55%[6]. Starting in 2001, the State Secretary of Penitentiary Administration (SSPA) progressively rolled out the Tuberculosis Control Program (TCP), based on detection strategies for cases, and supervised treatment in the prison units themselves. Hospitalization in the PS was limited to cases of bacterial resistance, cases associated with HIV/Aids or diabetes, cases of retreatment, or clinical complications resultant from the disease (p.ex. hemoptysis), or from treatment itself.

This article has as its aim the presentation of a group of multidisciplinary studies with operational objectives, developed from 2012, in Rio de Janeiro's Penitentiary System, in partnership with various research institutions. It presents control strategies they developed, as wellas discussing the difficulties encountered in the day-to-day reality of prison life for the implementation of measures of proven efficacy.

Situation and research strategies

The initial objective of the research was to give quantitative visibility to the problem of TB and TB/HIV Co-Infection amongst PDLs, with the aim of convincing administrators regarding the seriousness of the problem. Between 2002 and 2013, researchers carried out various prevalence studies based on screening of cases through chest radiography of all the PDLs from a determined prison unit, independent of the existence of symptoms. According to the recommendations of den Boon et al.[7], anybody who presented any radiological pulmonary abnormality, mediastinal or pleural, suggestive or not of TB, was submitted to two microscopic sputum smear examinations for AFB, as well as a *Mycobacterium*

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tuberculosis (MTB) culture and DST. A study including 1969 individuals at the time of entry into the penitentiary system showed a prevalence of active TB of 2.7%[8], a high rate we can attribute to the prolonged stay of PDLs in very poor incarceration conditions in the police stations. This situation was subsequently modified with the deactivation of these holding cells. Studies into active TB in the already incarcerated population showed high prevalences of between 4.6%, 6.3%, and 8.6% respectively (3014 PDLs investigated), in three prisons[5], with rates of seropositivity for HIV of 14% between the TB cases and of 2% in PDLs without TB. The tuberculin skin test, systematically undertaken in one of the prisons showed a prevalence rate of latent tuberculosis infection (LTBI) of 63.7%.

The high TB endemicity in Brazilian prisons is not specific to the state of Rio de Janeiro. In Porto Alegre, radiological screening using the same method as that used in RJ showed a higher active TB prevalence (9.1%), of HIV infection (5.8%), and of TB/HIV Co-Infection (18.2%)[9,10]. This high HIV infection rates encountered is consistent with the particularly high frequency of HIV infection in Porto Alegre's general population in relation to the national levels[11,12].

Prevalence studies carried out in the prisons of other states showed active TB prevalences below 1%, less than that found in RJ and Porto Alegre, which could partly be a result of the low performance of screening methods based on the presence of symptoms[13-16]. Evaluation of the prevalence of LTBI in PDLs in Bahia[17] and São Paulo[14] showed high levels (64% and 73% respectively). A study recently undertaken in Mato Grosso do Sul encountered lower rates of LTBI prevalence, between 3 and 32%depending on the prison investigated. There was however a 5% growth per year of incarceration, suggesting a significant circulation of MTB in the population in question[16]. These variations of ILTB prevalence amongst PDLs could partially be the result of different endemic TB levels, according to state or country.

Though numerous studies in the international literature report elevated rates of resistance to anti-tuberculosis drugs in prisons[18], there has never been any systematic research at the national level regarding the prevalence of resistance in the Brazilian prison population. This is despite the fact that for the PNCT, the realization of the TSA would be advisable in all cases of TB diagnosed in prisons[19]. An investigation recently carried out in the Penitentiary System of the State of RJ showed a multi-drug resistance rate of 1.5%, in agreement with previously published findings[5], and similar to the rate found in the state's general population. Studies undertaken in different prisons in the South of the country showed drug resistance rates ranging from 8% to 15%[9,10].

The prevalence studies realized in RJ prisons allowed the collection of important information that contributed to the elaboration of more efficient strategies for systematic active detection of cases. For example, only one third of TB cases identified by radiological screening, in individual interviews, had a cough $\geq$ 3 weeks, and the greater majority (74%) reported not feeling sick. In this manner, in the population under observation, screening based on the presence of symptoms would have identified only a small proportion (14%) of the sick[4,5].

In the same way, another objective of our research was to identify risk factors associated with active TB, which could inform the elaboration of detection strategies. Considering radiological screening to be a reference method, we evaluated the performance of the score proposed by the WHO[20] which would permit the identification amongst PDLs, of those who presumably had active TB. In our population sample, the performance of this score was mediocre, as well as for the other score derived from the multivariate analysis that we performed using data obtained during prevalence studies mentioned above[21].

The comparative evaluation for the performance of different TB detection strategies detection in the penitentiary setting is particularly difficult to carry out from an operational and ethical standpoint. Therefore, we developed a mathematical model that permits the comparison of five strategies and estimates the impact of each one of them on TB prevalence over a ten-year period[22]. The strategy which showed itself to be most effective, associated with the basic measures (passive case finding and treatment of cases), a systematic radiological exam applied on entry to the penitentiary system and, annually, for the entire incarcerated population.

It was fundamental therefore, to evaluate the "the real world" impact of the strategy that the modelling showed to be most effective. For this purpose, over two years, we systematically carried out chest x-rays in a prison that housed 1374 PDLs at the beginning of the study, both for inmates entering the prison and for the general prison population at two moments: at the start of the study and at the end of the first year, on top of case-finding from spontaneous attendance.

Showing the impact of this strategy, TB prevalence went from 6% for the initial screening, to 2.8% by the end of the first year, while prevalence amongst people entering the prison remained stable at 3% over the two years of the study. The number of cases identified due to spontaneous attendance went down significantly between the first year (4045 people/year), and the second (2181 people/year)[23]. The limitation of this study is the absence of a control population on which we did not apply the intervention, due to previously mentioned difficulties.

A complementary study undertaken in the same prison with RFLP techniques and spoligotyping showed that 83% of the MTB strains belonged to one of the 13 identified clusters, suggesting that intra-institutional transmission substantially contributed to the high TB endemicity[24]. Another study carried out in Rio Grande do Sul prisons[10] reported a similar finding. Additional research allowed the expansion of our study of strains in circulation in the prison investigated to better evaluate the epidemiological dynamic of MTB strains according to genotype[25].

The performance of the molecular Xpert MTB/RIF assay, whose effectiveness has been well documented in the general population[26] but to a lesser extent in confined highly endemic settings, was evaluated in the routine of the RJ prisons health service. This test allowed the identification of 40% more TB cases in comparison to the sputum smear examinations[27].

In the majority of publications about TB control in prisons, researchers mentioned the necessity of improving the environmental conditions of incarceration. They rarely put forward however, concrete proposals. As part of the Global TB Brazil/prisons Project Fund, we developed a program of national reach, in partnership with the National Penitentiary Department/Justice Ministry, whose objective was the proposal of realistic strategies for improving natural ventilation and illumination conditions in prisons. With the participation of architects, health care and security professionals, civil society organizations, the Public Ministry, and Penal Judiciary, regional workshops were carried out which resulted in the elaboration of the *Manual for Environmental Interventions for Tuberculosis Control in Prisons*[28]. We distributed the manual amongst these bodies and agencies, in particular, for the directors of the 1302 prison units in the country. The results obtained served as a basis for the elaboration of federal norms for the construction and reform of prisons[29].

Improving environmental conditions is of great importance, however modelling work undertaken by South African researchers[30] suggested that overpopulation played an even more significant role in TB dissemination than bad ventilation. Growing overcrowding in prisons put Brazil's penal policy in check, to the extent that in equalizing punishments for drug trafficking and heinous crimes and in prioritizing incarceration to the detriment of other penal alternatives[31,32], it contributed to the sharp spike in PDL numbers in recent years.

We consider of particular importance for the development of interventions adapted to the complexity of prison institutions[35] research in the area of psychosociology[33,34]. Imprisoned people are subjected to penitentiary administration, which fundamentally contents itself with incarceration, while neglecting its role of social reintegration. Allocated in the prisons according to the criminal groups that dominate their communities of origin, the parallel power of these factions[5] also equally dominates the PDLs. This double control in a highly hierarchized environment exacerbates the vulnerability of PDLs, driving them to prioritize their survival over health whereas, at the same time, the penitentiary administration prioritizes security.

Our studies show how penitentiary agents and the parallel organizations of the PDLs that maintain the governance of the prisons[36] control access to the health care services, frequently using criteria distinct from those of health care itself, transforming access to the service into a bargaining chip. In an environment where inmates greatly valorize virility and strength, the image of fragility resultant from TB, associated with the fear of discrimination due to practices connected to risk of contagion that ignores the context, such as prolonged isolation and the use of masks, frequently leads the patient to delay seeking diagnosis, which contributes to the reproduction of intra-institutional transmission.

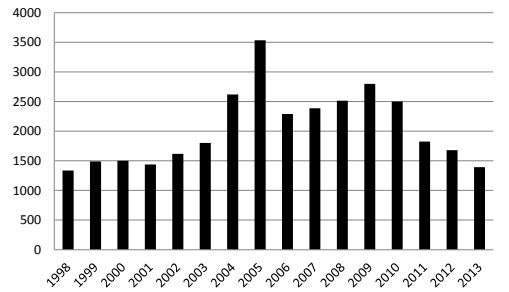
The prison population commonly mistrusts health measures due to the deficiencies of health care services. Poor working conditions not permitting an adequate response to ethical and technical professional demands, demotivate health care professionals, beyond simply their inadequate numbers and dependency on a penitentiary administration that neglects them[33].

Health services suffer from being mainly curative, with an inefficient reference and counter-reference system, limited by the absence of independent health transportation and by the in-

human conditions in which the transport occurs. For incarcerated individuals, who tend to reject any type of imposition beyond those already demanded by their environment, the coercive strategies frequently used by health professionals, particularly to ensure that DPLs take their TB medication have in our experience limited effectiveness.

The continuous thread connecting this group of research projects relates to their development in response to questions emerging from the day-to-day experience of health care professionals in the prison system, directly involved in the realization of the different studies[37]. The results of these studies contributed to the elaboration of normative documents for the Justice Ministry[29,38], and the Brazilian Health Ministry, particularly the PDL chapter from the National Manual for TB Control[19], as well as the elaboration of the National Program for TB Control of Ivory Coast, on the occasion of consultation.

Based on the results of this group of studies, advocacy initiatives were elaborated in collaboration with administrators, members of civil society and judicial powers active in the penitentiary system, as well aspublic health professionals and researchers[1,39-41].



Graph 1. Annual detection rates per 100,000 of tuberculosis cases in the in the Rio de Janeiro State penitenciary system, 1998-2013.

The reality of TB control programs in prisons in RJ

The analysis of the SSPA TB control program, in place since 2002 in the RJ Penitentiary System, reveals difficulties encountered for the maintenance of the control measures suggested by the research, demonstrated to be effective and viable in the functioning of the prisons.

Health check-up for entrants to the prison system, which include an active TB search, is implemented in a partial and intermittent manner. The active systematic search in the already incarcerated population, which contributed considerably to the increase in rates of detection of cases during the years in which it was carried out between 2004 and 2010 (Graph 1), ceased to be carried out owing to a lack of maintenance of the Mobile Radiology Unit. On the other hand, the percentage of patients with TB, tested for HIV, increased considerably starting from 2011, with the rate of application of the exam above 90%, thanks to the provision of rapid testing and training of nurses to carry it out.

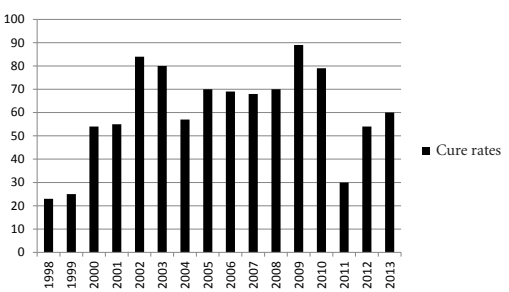
The intermittent availability of services hampered the realization of the Xpert MTB/RIF assay, introduced into the PS laboratory in 2011.

To strengthen adhesion to treatment, staff implemented a strategy in the prison unit itself, seeking to share responsibility with the inmate for its treatment. The treatment is self-administered with weekly delivery of medication and a consultation with a nurse every two weeks which communicates a sense of personal care to the patient, to the contrary of the coercive strategies implemented in some countries[42]. Together with this, patients in treatment and ex-patients, under the coordination of a nurse, carried out weekly discussion groups in the 15 prison units with the highest number of cases, seeking to guarantee adhesion to treatment. This activity however, ended in 2012. Despite technical analysis realized in some RJ prison units, the penitentiary administration did not consider the environmental intervention proposals.

We developed a wide ranging information, education, and communication initiatives with the support of the Global TB-Brazil Project Fund, with the objective of involving the DPLs, their families, and the professionals who work in prisons, through discussion roundtables, production of information folders, videos, theater, and a drawing competition etc.[38]. In particular, we counted on the participation of religious groups and teachers, whose word is taken as "more reliable" by the PDLs, for not depending on the penitentiary administration and security. The theme of TB was introduced into the education courses and updating sessions for security and transport agents at the School of Penitentiary Management, and through discussion groups with guards in the main state prisons.

The training and performance of PDL health advocates should be an important goal for the prison PCT. However, we encountered great difficulties to implement this strategy, initially owing to problems with selecting them independently of the penitentiary administration and PDL leaders, knowing that the whole motivation of this strategy is to confer on the prisoner a certain power and a relative liberty of self-determination. Difficulties in organizing meetings with the selected PDLs and the frequent transfers between the diverse prison units quickly undid the network of advocates.

Even admitting these many limitations, the PCT in RJ prisons allowed the attainment of results that seemed of value to us. As figures 1 and 2 show, the annual detection rates that were around 1500/100,000 until 2001, reached levels close to 2500 by 2004, even reaching 3500/100,000 in 2005. In a similar way, the cure rates cure rapidly increased beginning in 2002, becoming higher than those for the state of RJ in general, with a tendency for growth over the nine-year period arriving at 89% in 2010. The maintenance of high cure rates confirmed the adequacy of the treatment strategy implemented, and contributed to explaining the low rate of drug resistance observed in the RJ prisons (rate of TB/MDR: 1.5%). The mortality rate for TB amongst the PDLs however, which is an important performance indicator for the TB control program, is not available.



Graph 2. Cure rates (%) of tuberculosis cases in the in the Rio de Janeiro State penitenciary system, 1998-2013.

The Sustainability of the TB control programs in RJ prisons

Though positive results have been demonstrated over a 10 year period, the program remained precarious, as the significant and rapid fall in detection and cure rates starting in 2011 demonstrates, with the a return to levels lower than those found prior to the implementation of the program in 2001. Such an evolution is attributable to a reorganization of health infrastructure and patient flows, and to the precariousness of the health care services in terms of functioning, human resources, and circulation of the treatment supervision teams, medication, and sputum samples, between the PS and the prison units.

This situation reflects the limited motivation of the penitentiary administration and of the state and municipal health secretaries to assume responsibility and ensure financing of the health care measures intended for the PDLs. It demonstrates a disrespect for the rights of PDLs to health care, who should constitutionally benefit from the same quality of care as that offered to the general population, as a responsibility of the state. We have shown this elsewhere in the analysis we carry out in conjunction with jurists[43]. Being sentenced to a deprivation of liberty does not deprive inmates of their rights to health care, however respect of human rights unfortunately, continues mainly at the level of discourse. The judicial decision that considered the measures proposed by the Public Ministry of the State of RJ unfounded equally demonstrated this. This was after the Public Hearing held in 2012 in the Legislative Assembly of the State of Rio de Janeiro during which we publicly showed the gravity of the TB situation and its deteriorating levels of control in prisons in the State of RJ[44].

In this context, the most effective performance of the departments charged with monitoring the fulfillment of the sentence such as the Penal Judiciary, the Public Ministry, The public defender, and the Community Council amongst others, becomes necessary in terms of safe guarding imprisoned persons. This is especially true for TB control, access to preventative measures, and adequate care, according to the inmate's constitutional right to health. In the judgment of the Exceptional Appeal EA 841526, the Federal Supreme Court stated that: "If the State has a

duty of custody, it also has the duty to defend the physical integrity of the prisoner"[45].

Conclusion

The approach used illustrates the need, in such a specific setting as that of the prison, for multi-disciplinary research directly involving all actors of prison life. Evidently, this group of studies carried out in RJ prisons is far from responding to all the questions concerning the optimization of TB control in this environment[46]. We still need to undertake an in depth investigation of some important issues. These include the place of the Xpert MTB/RIF assay, amongst other approaches, for active case-finding, the effectiveness and viability of ILTB treatment, the "governance" of healthcare in the penitentiary system, and TB control initiatives in the context of the "municipalization" of prison health care, the last item recommended by the National Policy for Health Care for Individuals Deprived of Liberty in the Prison System in the sphere of the Universal Health Care System[47]. This issue should be addressed using methodologies of public policy analysis[48].

Finally, scientific evidence concerning the seriousness of the problem and the measures that must be implemented to mitigate it does not seem sufficient to convince administrators to assume their responsibilities for the health of PDLs. This situation then, reproduces itself owing to the inertia of management in terms of adopting the findings of agencies responsible for monitoring the fulfillment of sentences. There is also a lack of commitment from society generally to ensure dignified conditions of incarceration and health care access as indicated in international and national law[49,50], for inmates who are considered outsiders.

Collaborations

A Sánchez e B Larouzé contributed equally in the elaboration and writing of this article

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