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Prevalence of Pulmonary Tuberculosis among Inmates and Staff of Three Indian Prisons

A. D. Meundi[1*], M. D. Meundi[2], B. B. Dhabadi[1], M. I. Ismail[1], M. Amruth[1] and A. G. Kulkarni[1]

[1]Department of Community Medicine, KVG Medical College, Sullia, Karnataka State, India.
[2]Department of Microbiology, KVG Medical College, Sullia, Karnataka State, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author ADM conceived the study, planned the data collection and data analysis and prepared the draft and final manuscript. Author MDM performed the fluorescent microscopy of the sputum samples. Authors ADM, BBD, MII and MA collected the data. Author AGK reviewed the manuscript prior to finalization.

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Short Research Article

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ABSTRACT

Aim: To estimate prevalence of TB among inmates and staff of three prisons in south India.
Place of Study: The study was undertaken in three purposively selected prisons in Karnataka State, India, namely, Belgaum, Mysore and Mangalore prisons.
Methodology: A descriptive, cross-sectional study was undertaken among a total of 2450 inmates and 280 staff at the three selected prisons. Inmates and prison staff were screened for cough of ≥ 2 weeks and the identified TB suspects were subjected to sputum microscopy for acid fast bacilli using ZN staining and fluorescent microscopy.
Results: 81 TB suspects were identified among the inmates and none among the staff. Of the 81 TB suspects, none were positive for acid fast bacilli. 10 inmates at the prisons were already on DOTS for pulmonary TB. A prevalence of pulmonary TB of 4/1000 prison inmates was estimated. Unmet need for medical care was elicited among TB suspects. Past history of anti-TB treatment and

**Corresponding author: Email: anandmeundi@yahoo.com;*

history of current smoking were identified as significant risk factors for TB in the selected prisons. **Conclusion:** The estimated prevalence of pulmonary TB in the selected prisons (4/1000 prison inmates and staff) was almost twice that in the Indian general population (2.11/1000 general population).

Keywords: Tuberculosis; penitentiary settings; Karnataka state.

1. INTRODUCTION

Globally there were 9 million incident cases, 13 million prevalent cases and 1.5 million deaths due to tuberculosis (TB) in 2013 to which South-East Asia and Western Pacific regions contributed to about 56% [1]. India accounts for the largest proportion of TB cases with 24% of global TB burden and stands 17th among the 22 high burden countries in terms of incidence rate. In India, the Revised National TB Control Programme (RNTCP) has achieved a New Sputum Positive Case Detection rate of 71% and Treatment Success rate of 87% in 2010 against the fixed RNTCP targets of 70% and 85% respectively [2]. With an ambitious goal of elimination of TB and with a vision of TB free India, the RNTCP aims to achieve early detection and treatment of at least 90% of estimated TB cases in the community. This has been termed "Universal Access to Quality TB Diagnosis and Treatment" [2].

Universal access entails amongst other strategies, providing special attention to high risk groups like migrants, homeless people, PLHA (persons living with HIV/AIDS), alcoholics and prison inmates to mention a few. There are several studies / reviews which have been undertaken abroad which have found an increased TB burden in prisons compared to the general community [3-11]. Baussano et al. [5] clearly articulate the reasons why prisons represent a reservoir for TB disease transmission to the community at large and suppose that TB infection may spread into the general population through prison staff, visitors and close contacts of released prisoners. In an official statement issued by the International Union against Tuberculosis and Lung Disease, attention is drawn to the fact that health of the prisoners is an inseparable component of the health of the larger community and therefore calls for scaling up of strategies to control TB in prisons. The statement also calls for promotion of operational research to build evidence which can inform better control of TB in prison settings [10]. Studies undertaken to assess prevalence of TB in prison settings in India are sparse. In this context, the present study aimed at an appraisal of burden of TB among inmates and staff of three prisons in south India.

2. MATERIALS AND METHODS

A descriptive, cross-sectional study was undertaken in three purposively selected prisons in Karnataka State, India, namely, Belgaum, Mysore and Mangalore prisons from September to December 2011. Of these prisons, Belgaum and Mysore prisons are central prisons and Mangalore prison is a district prison. The composition of the three prisons at the time of the study is given in Table 1.

Approval was obtained from K V G Medical College institutional ethics committee for the present study. Total enumeration of all consenting prisoners and prison staff in the three prisons was made. Any inmate or staff with history of cough of ≥ 2 weeks was considered as a TB suspect and was subjected to sputum examination for acid fast bacilli (AFB) using ZN (Ziehl Neelsen) stain at a local government health facility as per RNTCP guidelines (two sputum samples of which one was spot and the other was an early morning sample). An informed consent was obtained from all TB suspects who were subjected to sputum examination. All

Table 1. Composition of the three prisons at the time of the study

Prison	Number of inmates (under trial and convicted)	Number of staff	Total	TB suspects identified from each prison
Belgaum	1100	130	1230	47
Mysore	1050	130	1180	21
Mangalore	300	20	320	13
Total	2450	280	2730	81

sputum samples were also transported to KVG Medical College, Sullia and were subjected to fluorescent microscopy for M. tuberculosis using a LED illuminated binocular microscope at the department of Microbiology. Proper cold chain and infection control measures were undertaken while handling/transporting sputum samples. A repeat sputum examination and chest X ray (where indicated) were carried out after 14 days for those inmates/staff with initial negative sputum results as per RNTCP guidelines. A positive sputum result with either ZN staining or Fluorescent microscopy was considered as an evidence for initiating anti-TB treatment.

3. RESULTS

Majority of the TB suspects were males (78/81, 98%) and were almost equally distributed in the age groups 20-35 years, 36-50 years and 51-65 years each. Seventy three per cent of the TB suspects were married, 84% were in the IV and V socioeconomic classes (modified B G Prasad classification) and 80% hailed from rural areas. At the time of the study, 10 prison inmates were already on anti-TB treatment. Of the 10 prison inmates on anti-TB treatment, a large proportion (6/10, 60%) were in the 20-35 years age group followed by 3 inmates in the 36-50 years age group, 8 (8/10,80%) were married, 8(8/10,80%) were in the IV and V socioeconomic classes classes (modified B G Prasad classification) and 5 each (5/10,50%) hailed from urban and rural areas.

3.1 Prevalence of Pulmonary TB among Inmates

Of the total of 2450 inmates on the day of the visit to the three prisons, 81 TB suspects were identified. Of the total of 280 staff at the three prisons, no TB suspects were identified. No new pulmonary TB case was identified among the 81 TB suspects after subjecting them to sputum examination as per RNTCP guidelines and also fluorescent microscopy. However 10 prison inmates were already on DOTS (Directly Observed Treatment Short-course) anti-TB treatment for pulmonary TB at the 3 prisons. This gives a prevalence of pulmonary TB of 4/1000 prison inmates (10/2450*1000).

3.2 Prevalence of Risk Factors for Pulmonary TB

Six inmates out of the 10 inmates (6/10, 60%) on anti-TB treatment and 15 out of the 81 TB suspects (15/81, 18.5%) were malnourished (BMI< 18). Sixty-nine (85%) of the 81 TB suspects had consulted the prison medical officer about their cough. Out of them 47 (68%) did not find any relief. Only 2 of the TB suspects re-consulted the prison medical officer and both of them had not found relief even after the second consultation. Half of the inmates on anti- TB treatment (5/10) gave history of exposure to one or more TB cases known to them in the prison, whereas 30(30/81, 37%) TB suspects gave a similar history. Half of the inmates on anti-TB treatment (5/10) had taken anti- TB treatment in the past (in the prison or outside) whereas only 9 TB suspects (9/81, 11.1%) gave a similar history. This difference was statistically significant (Table 2).

Three inmates on anti-TB treatment (3/10, 30%) and 39 inmates who were TB suspects (39/81, 48%) gave history of a previous incarceration. The median duration of previous incarceration among TB suspects was 12 months and among inmates on anti-TB treatment it was 24 months. The median duration of present incarceration among TB suspects was 20 months and among inmates on anti-TB treatment was 11 months. All the inmates on anti-Tb treatment were current smokers whereas 48 TB suspects (48/81, 59.3%) were currently smoking. This difference was statistically significant (Table 3). In addition, 56 TB suspects (56/81, 69%) were exposed to passive smoking in their place of incarceration. None of the inmates on anti-TB treatment were known diabetics or asthmatics. Six per cent (5/81) and 16% (13/81) of TB suspects were diabetics and asthmatics respectively.

Table 2. Past history of anti-TB treatment among the study subjects

Past history of anti-TB treatment		TB suspects (%)	Inmates currently on anti-TB treatment (%)	Total (%)
	Yes	9 (11.1)	5 (50)	14 (15.4)
	No	72 (88.9)	5 (50)	77 (84.6)
Total		81 (100)	10 (100)	91 (100)

Fisher's exact test; p = 0.007 (2 sided)

Table 3. History of active smoking among the study subjects

History of active smoking		TB suspects (%)	Inmates currently on anti-TB treatment	Total
	Yes	48 (59.3)	10 (100)	58 (63.7)
	No	33 (40.7)	0 (0)	33 (36.3)
Total		81 (100)	10 (100)	91 (100)

Fisher's exact test; p = 0.012 (2 sided)

4. DISCUSSION

The present study estimated a prevalence of pulmonary TB in the three prisons of 4/1000 prison inmates. This was almost two times the estimated prevalence of pulmonary TB of 2.11/1000 in the Indian general population [1]. It is to be noted that the calculated prevalence is based on 10 inmates who were already on anti-TB treatment at the time of this study. No new cases of TB were identified either among the TB suspects or among the prison staff. The prevalence estimated in the present study could be an underestimate, considering the low sensitivity of using "cough for ≥ 2 weeks" criteria to identify TB suspects. Several surveys have noted very high prevalence of pulmonary TB [4,6,7,9,11]. Ranging from 6.5 to 27/1000 inmates. The prevalence estimated in the present study is low compared to the findings of previous studies (Table 4). The estimate that is closest to the present study is that of a Ugandan study where an estimate of 6.4/1000 inmates was documented and which was almost thrice that of the prevalence in the Ugandan general population [11].

Table 4. Comparison of prevalence of pulmonary TB obtained in this study with previous relevant studies

Author (N)	Methodology adopted	Year	Place	Prevalence of pulmonary TB (per 1000 inmates)
Sanchez and Gerhardt [9] **N = 1052**	Screening all inmates by chest X ray, followed by sputum examination of those with abnormality on chest x ray by ZN stain for AFB and culture.	2005	Brazil	46.0
Sanchez A et al. [7] **N = 1696**	Screening all inmates by chest X ray, followed by sputum examination of those with abnormality on chest x ray by ZN stain for AFB.	2009	Rio de Janeiro, Brazil	27.0
UNODC **N = 459 [11]**	459 inmates randomly selected from 34 randomly selected prisons. Sputum samples of those clinically suspected as having TB examined by ZN staining for AFB.	2009	Uganda	6.54
Banu S et al. [4] **N = 11,000**	Screening all inmates for Cough ≥ 3 weeks followed by sputum examination of TB suspects using Z N stain for AFB and culture.	2010	Dhaka, Bangladesh	22.27
Kazi AM et al. [6] **N = 365**	365 inmates randomly selected, and screened for possible TB (WHO criteria), followed by sputum examination by ZN stain for AFB and culture.	2010	Karachi, Pakistan	22.0
Present study **N = 2450**	Screening all inmates for cough ≥ 2 weeks followed by sputum examination of TB suspects using Z N stain for AFB and fluorescent microscopy.	2011	Karnataka state, India	4.0

In the present study, a large proportion (6/10, 60%) of inmates on anti-TB treatment were undernourished (BMI < 18). This finding is in consonance with studies carried out in Dhaka, Bangladesh [4] where a BMI of <18 was a significant risk factor for TB in prison. In a study aimed at deriving a screening rule for TB in prisons, carried out Zambia, Harris J B et al include a low BMI (<18.7) as a potential marker for TB screening [3]. The fact that the present study has demonstrated that more than two-thirds of TB suspects did not find relief after consulting the prison medical officer and that only two of them had a second consultation points to an unmet need for medical care in prisons. Similar circumstances have been encountered in several studies carried out in prisons in resource poor settings [12-15]. There is one underlying concern that is expressed by authors of these studies – lack of quality of care for prison inmates, combined with a high prevalence of pulmonary TB can adversely impact TB control in prisons and outside it.

A greater proportion of inmates on anti- TB treatment in the present study had history of exposure to TB cases known to them in prison and, history of previous anti-TB treatment. The inmates on anti-TB treatment also had a greater duration of previous incarceration compared to the TB suspects. Studies carried out in the past have also documented history of exposure to TB cases in the prisons [4], history of previous anti-TB treatment [7] and history of previous incarceration [4] as risk factors for TB in prisons. In the present study, all the 10 prison inmates on anti-TB treatment and two thirds of TB suspects were current smokers. Since none of the 81 TB suspects were positive for sputum microscopy for AFB, smoking cannot be ruled out as the cause of persistent cough of 2 weeks among the TB suspects.

5. CONCLUSION

The sampling of the prisons was purposive and so, the results may not be representative of all Indian prisons. In addition, the screening of prison inmates by cough of ≥ 2 weeks might have a lower sensitivity for picking up TB suspects compared to other forms of initial screening [16]. Nonetheless, the present study has been successful in demonstrating the fact that the prevalence of pulmonary TB in prison settings is at least double that of the general population if not higher. It is also evident from the present study that a low BMI, previous history of anti-TB treatment and long duration of previous incarceration are potential risk factors for TB in Indian prisons. Given the available evidence from published reports that active smoking is associated with TB disease, TB infection and mortality due to TB [17], the high prevalence of active smoking in prisons as demonstrated in the present study, can turn into a formidable obstacle for TB control in prisons in resource poor settings in general and in India in particular.

CONSENT

All authors declare that 'written informed consent was obtained from the study subjects for carrying out sputum examination, for interviewing them and for publication of the findings of this study. Prior permission was obtained from the Office of Additional Director General of Prisons, Karnataka for undertaking this study and for publication of the findings of this study.

ETHICAL APPROVAL

Approval was obtained from K V G Medical College, Sullia Institutional Ethics Committee for the present study.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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