

## Pulmonary tuberculosis: a public health problem amongst the Saharia, a primitive tribe of Madhya Pradesh, Central India

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### SUMMARY

**Objectives:** To estimate the prevalence of pulmonary tuberculosis (TB) disease amongst the Saharia, a 'primitive' tribe of Madhya Pradesh, Central India.

**Methods:** A community-based cross-sectional TB prevalence survey was undertaken in the Saharia, a 'primitive' tribal community of Madhya Pradesh. A representative random sample of villages predominated by tribal populations was chosen from the selected block of Sheopur District. All eligible individuals were screened for chest symptoms related to TB. Sputum samples were collected from all eligible individuals, transported to the laboratory, and examined by Ziehl–Neelsen smear microscopy and solid media culture methods.

**Results:** Of the 11 468 individuals eligible for screening, 11 116 (96.9%) were screened for symptoms. The overall prevalence of pulmonary TB disease was 1518 per 100 000 population. Prevalence increased with age and the trend was statistically significant ( $p < 0.001$ ). The prevalence of pulmonary TB was also significantly higher in males (2156/100 000) than females (933/100 000) ( $p < 0.001$ ).

**Conclusion:** The findings suggest that TB disease remains a major public health problem in the Saharia 'primitive' tribal community of Madhya Pradesh, Central India.

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### 1. Introduction

Tuberculosis (TB) remains a major public health problem in India and globally.<sup>1</sup> With over 1.9 million new cases annually, India is the highest TB burden country in the world, accounting for one fifth of the world's new TB cases and two thirds of the cases in the Southeast Asia region.<sup>1,2</sup> The prevalence of TB disease is an important epidemiological index to measure the burden in a community. Epidemiological information on TB is also vital for the planning of control strategies and service delivery systems. A nationwide disease survey conducted by the Indian Council of Medical Research (ICMR) during 1955–1958 provided information on the TB disease situation in the general population of the country for the first time.<sup>3</sup> However, information on the TB situation in the tribal populations of India is limited to a few studies carried out in small populations scattered across the country.<sup>4–8</sup>

The tribal populations are groups of people who share common cultural and socio-religious beliefs, and reside in particular discrete geographic areas. Their cultural and socio-religious beliefs

are quite different from those of the wider general population. They are an underprivileged group of society, often having poor access to healthcare delivery systems. As per the 2001 National Census, the tribal population is estimated at 84.32 million, representing 8.2% of the country's total population.<sup>9</sup> In the central Indian state of Madhya Pradesh, it accounts for about a quarter of the total state population. The various tribes living in the State have been categorized into 46 ethnic groups. Three groups among them are identified as 'primitive' because of their relative backwardness, isolation, and neglect in the past. The Saharia are one of these three primitive tribes. The word 'Saharia' is a combination of the two words 'Sa' (companion) and 'Haria' (tiger), meaning 'companion of the tiger'.<sup>10</sup> The economy of the tribe is based on agriculture, labor, and wood cutting. A TB disease prevalence survey conducted by the Regional Medical Research Centre for Tribals (RMRCT) in 1991–1992 showed a high prevalence of TB disease (1270/100 000 population) amongst them.<sup>4</sup> There has been no further, more recent information regarding the TB situation in this primitive tribe since then.

This paper provides information on the current TB disease situation in this primitive tribal community, resulting from a recently conducted community-based disease prevalence survey in the same area.

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## 2. Materials and methods

### 2.1. Study area

The study was carried out in the Karhal block, Sheopur District from November 2007 to March 2008. Karhal is situated about 40 km from the District headquarters. The terrain is difficult, with most of the villages located in remote jungle areas having poor connectivity by road, which remain cut off from the surrounding areas during the rainy season.

### 2.2. Study population

The required sample size was estimated to be approximately 11 000 adults aged  $\geq 15$  years for an assumed prevalence of 1270/100 000 bacteriologically positive TB,<sup>4</sup> with a precision of 25% at a 95% confidence level, a design effect of 2 for cluster sampling, and coverage for examination of at least 90%.

All the villages in the block were arranged in descending order of the tribal population, and a list of the villages predominantly covered by the tribal population (80% and above) was prepared. The required number of villages (a village was considered as a sampling unit for the survey), was selected at random in order to cover the estimated sample size. The study was approved by the ethics committee of RMRCT.

Planning visits were made to the villages prior to the survey to inform village leaders of the purpose of the survey. Group meetings were also conducted to explain the purpose of the study to the community and to seek their co-operation. A complete census of the selected villages was done by house to house visits, and all individuals excluding visitors to the household were registered. Relevant data were collected on an individual card in a pre-coded form. Informed written consent was obtained from all individuals included in the survey.

### 2.3. Symptom screening and sputum collection and processing

All individuals aged 15 years and above were questioned regarding the presence of chest symptoms relating to TB, namely: persistent cough for 2 weeks or more; chest pain for 1 month or more; fever for 1 month or more; and hemoptysis. Persons with any of these symptoms ('chest symptomatics') were considered eligible for sputum collection. Persons with a previous history of anti-TB treatment were also considered eligible for sputum collection. Two sputum samples (of at least 2 ml each) – one spot and one overnight – were collected from all eligible individuals in sterilized McCartney bottles.

Portable refrigerators were carried to the field. The samples were stored in the refrigerator in the field and were transported to the laboratory maintaining a cold chain. They were kept at +4 °C in the laboratory until processing.

Direct smears were made from all sputum specimens. The smears were stained by Ziehl–Neelsen (ZN) method and were examined for acid-fast bacilli (AFB).<sup>11</sup> The specimens were also processed for culture by modified Petroff's method and were examined for growth of *Mycobacterium tuberculosis* once a week for

8 weeks. The niacin test and growth on para-nitrobenzoic acid was done to confirm the growth of *M. tuberculosis*.<sup>12</sup> In addition, all positive smears and a 20% random sample of negatives were read once again for quality control purposes.

### 2.4. Case definition and treatment

A pulmonary TB (PTB) case was defined as an individual whose sputum was positive for AFB by ZN microscopy and/or growth of *M. tuberculosis* by culture examination.

All bacteriologically positive cases were referred to the concerned health authorities for anti-TB treatment, under intimation to the State TB Officer.

### 2.5. Statistical analyses

The data were computerized, edited, and corrected for mistakes, if any, and analyzed using SPSS software package (version 13.0; SPSS Inc., Chicago, IL, USA). The Chi-square test of significance was applied to the difference in proportions of symptomatic individuals and cases among different classifications. Linear trend in proportions was tested for significance using the trend Chi-square. The 95% confidence intervals (CI) were estimated using the appropriate cluster sampling formula for the variance of the prevalence estimate. A *p*-value of  $<0.05$  was considered to be statistically significant.

## 3. Results

A total of 33 randomly selected villages were covered by the study. Of the 11 468 individuals eligible for screening, 11 116 (96.9%) were screened for symptoms. Of these, 1269 (11.4%) individuals were found to be symptomatic. Sputum was collected from 1248 (96.3%) of the symptomatic individuals who were eligible for sputum collection. Thus, the coverage for symptom elicitation and sputum collection were both above 95% (Table 1).

The proportion of males eligible for sputum collection was higher (15.2%) than that of females (8.0%) (Table 2), and the difference was statistically significant ( $p < 0.001$ ). The proportion of symptomatic individuals eligible for sputum collection increased from 4.1% in the 15–24 years age group to 24.1% in the 55+ year age group; the increase in trend was statistically significant ( $p < 0.001$ ) (Table 3).

The overall prevalence was found to be 1518 (95% CI 1208–1829) per 100 000 population. The prevalence of PTB in males (2156/100 000; 95% CI 1686–2625) was more than double that amongst females (933/100 000; 95% CI 608–1257) ( $p < 0.001$ ; Table 2 and Figure 1). The prevalence increased with age, being 546

**Table 1**  
Coverage of the TB prevalence survey

Activity	Coverage (%)
Individuals eligible for screening	11 468
Individuals screened	11 116 (96.9)
Sputum eligible	1269 (11.4)
Sputum collected	1248 (98.3)

**Table 2**  
Prevalence of tuberculosis among tribal men and women

Sex	Individuals eligible for screening	Number screened	Eligible for sputum (%)	Number having sputum collected	Number sputum-positive	Prevalence per 100 000 population (95% CI)
Male	5574	5321	808 (15.2)	796	113	2156 (1686–2625)
Female	5894	5795	461 (8.0)	452	53	933 (608–1257)
Total	11 468	11 116	1269 (11.4)	1248	166	1518 (1208–1829)

CI, confidence interval.

**Table 3**  
Prevalence of TB in the tribal population by age group

Age group (years)	Individuals eligible for screening	Number screened	Eligible for sputum (%)	Number having sputum collected	Number sputum positive	Prevalence per 100 000 population (95% CI)
15–24	4021	3921	160 (4.1)	157	21	546 (343–749)
25–34	2733	2654	289 (10.9)	280	32	1244 (907–1582)
35–44	1998	1923	245 (12.7)	244	36	1880 (1288–2472)
45–54	1344	1297	256 (19.7)	254	37	2875 (1911–3839)
55+	1372	1321	319 (24.1)	313	40	3086 (2039–4133)
Total	11 468	11 116	1269 (11.4)	1248	166	1518 (1208–1829)

CI, confidence interval.

per 100 000 (95% CI 608–1257) in the 15–24 years age group, increasing to 3086 per 100 000 (95% CI 343–749) in the 55+ years age group (Table 3 and Figure 1). The increase in trend with age was statistically significant ( $p < 0.001$ ).

#### 4. Discussion

TB is predominantly a disease of disadvantaged and marginalized groups, particularly the poor and hard to reach groups. The present TB disease survey amongst the Saharia, a disadvantaged ethnic group of Madhya Pradesh, Central India, was undertaken to understand the TB situation in comparison to the findings of a previous survey conducted in the same population 15 years ago. An impressively high coverage for symptom screening and sputum collection was obtained despite the difficult terrain and other challenges faced by the survey team. The study provides important information on the TB disease situation in this primitive ethnic group of central India, showing a persisting very high prevalence of TB in this tribal population. Though disease prevalence surveys are costly and laborious, they give unbiased measures of TB burden and trends, and are justified in high-burden countries where many cases and deaths are missed by surveillance systems.<sup>13</sup> The findings of the present survey throw light on the current TB situation in this disadvantaged ethnic group, which will be useful in evaluating the impact of disease control measures and epidemiological trends over time by means of the conducting of repeat surveys in the coming years.

TB prevalence surveys have been carried out in different parts of the country, mostly in the general population (non-tribal)<sup>3,8,14–16</sup> and in a few isolated tribal communities.<sup>4–8</sup> Prevalence in the general population has been shown to range from 144 per 100 000 in Wardha District, Maharashtra State<sup>8</sup> up to 1070 per 100 000 in Raichur District, Karnataka.<sup>16</sup> From the limited studies in tribal populations, again a wide variation of prevalence rates has been reported, ranging from 133 per 100 000 amongst the tribal population in Wardha District, Maharashtra<sup>8</sup> to 1270 per 100 000 in the earlier survey amongst the Saharia tribe of Madhya Pradesh.<sup>4</sup>

However it needs to be noted that many of these studies were conducted decades ago. In a recent study (2004–2006) by the TB Research Centre (TRC), Chennai, the prevalences of culture- and smear-positive PTB were found to be 311 per 100 000 population and 169 per 100 000 population, respectively, in a peri-urban population of Thiruvallur District in the southern Indian state of Tamil Nadu.<sup>17</sup>

The earlier survey conducted in this primitive tribal community in 1991–1992 showed a very high prevalence of TB infection of 16.9% and an annual risk of TB infection (ARTI) of 3.3% amongst children, with an overall adult TB disease prevalence of 1270 per 100 000 population.<sup>4</sup> A recent ARTI study conducted in the same area during 2006–2007, showed a similar high prevalence of infection (20.4%) and ARTI (3.9%) among Saharia children, highlighting the continued high load of infectious cases in the community.<sup>18</sup> The present study found a disease prevalence rate of 1518 (95% CI 1208–1829) per 100 000 population. This indicates that there has been no real improvement in the TB situation in this primitive tribal group over the intervening 15 years.

The study findings that prevalence increases with age and is higher in males than females is consistent with the findings of many other studies.<sup>14,17,19–22</sup> The observed very high prevalence of TB disease in this primitive ethnic group needs to be further understood, particularly in light of another recent survey conducted by RMRCT in a wider group of tribal populations in 11 districts of Madhya Pradesh. The findings of that survey suggest that the TB disease situation in this wider tribal population (with a PTB prevalence of 390/100 000) is not that different from the situation in the non-tribal population of the country.<sup>23</sup> Consideration needs to be taken of the specific socio-cultural practices among the Saharia and the TB control efforts that have been implemented in their area of residence. Members of this tribe are known for their frequent movement or migration to other areas, in search of work, particularly during the summer months. Migration appears to increase the risk of HIV infection.<sup>24</sup> There is, however, no information on HIV status in the area. Though there is a wide variation in the prevalence of HIV infection in various regions of India, Madhya Pradesh is a low prevalence state.<sup>25</sup> Other factors such as poor hygiene practices, high levels of illiteracy, lack of awareness of diseases and available services, significant overcrowding, extreme poverty, etc., may also have played an important role in this worrying situation. A contributory role may also have been played by previous poor delivery of anti-TB services over four decades of implementation of the earlier National Tuberculosis Programme (NTP). The NTP was implemented in the country from 1962. However, its performance was far below expectation and the requirements for achieving TB control.<sup>26–28</sup> This is particularly relevant with respect to tribal populations considering the often difficult terrain in which they live, potentially resulting in irregular drug supplies and poor supervision by Programme officials. A study in the North Arcot district of Tamil Nadu state showed that only 41% of patients were successfully treated under the NTP.<sup>26</sup> In addition, the provision of poor quality TB services by the private sector in India has been well

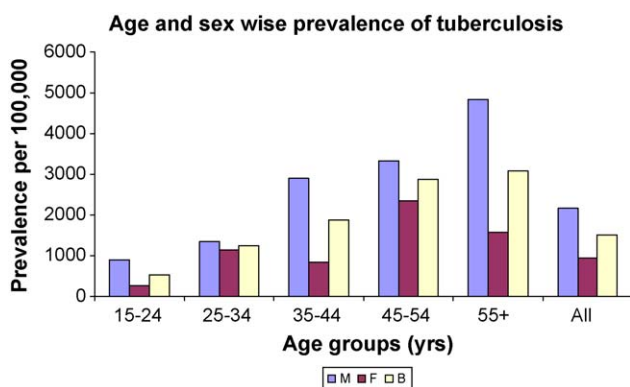


Figure 1. Prevalence of tuberculosis by age and by sex.

documented, and will have contributed to maintaining high levels of TB disease prevalence in the country in the past.<sup>29–31</sup>

Following a review of the NTP in 1992 by the Government of India (GoI), the World Health Organization (WHO), and the Swedish Development Agency, the GoI resolved to intensify its efforts to control TB and established the Revised National Tuberculosis Control Programme (RNTCP) in 1993, an adaptation of the internationally recommended directly observed treatment – short course (DOTS) strategy.<sup>32,33</sup> However, RNTCP has only recently been implemented in the survey area (in 2004). When effectively implemented over a number of years, the RNTCP has been shown to result in a significant decrease in the prevalence of TB disease, as demonstrated by the studies by the TRC in Thiruvallur District.<sup>17</sup> In view of the recent implementation of RNTCP in the survey area, it is unlikely that the TB prevalence in the community has as yet been affected by the RNTCP. A perusal of the sub-district level RNTCP reports for early 2008 shows a high case detection rate of 122% (of estimated expected cases) and a cure rate of 83% in the Sheopur Sub-district TB Unit (covering a population of around 500 000). The Programme performance has been seen to have gradually improved since implementation with an increase in the case detection rate from 99% in 2005 to 122% in 2008 and in the cure rate from 71% in 2005 to 81% in 2008. Continued implementation of quality RNTCP TB services over a number of years is expected to have an impact on the TB situation in this population and the area as seen in Thiruvallur District. Intensified Programme coverage, taking in the entire population of the area with case-finding and treatment of the cases, may also be attempted to interrupt the transmission of infection.

## 5. Conclusions

The continued high prevalence of TB disease observed in this ‘primitive’ tribe, albeit in a very small proportion of the country’s total population, highlights an urgent need to improve and further intensify TB control measures on an all population-wide, sustained, and long-term basis.

## Conflict of interest

The authors do not have any associations that might pose a conflict of interest.

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