

Original Research Article

Prevalence of adult pulmonary tuberculosis in rural community adjacent to an oil industry, Assam

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ABSTRACT

Background: To estimate the prevalence of adult pulmonary tuberculosis among rural community residing adjacent to Numaligarh Oil Refinery.

Methods: The present study was conducted from July 2019 to June 2020 in a rural area adjacent to Numaligarh Oil Refinery. Total 3600 study participants aged 15 years and above were enrolled by multistage stratified random sampling method and they were interviewed for PTB symptoms. Two sputum samples were taken from each symptomatic individual for microscopic examination in DMC and positive cases were taken as sputum smear positive PTB. Sputum smear negative presumptive cases had undergone CXR and CB-NAAT examination.

Results: Total 27 sputum smear positive cases revealing prevalence of smear positive cases 750 per lakh population. 12 CXR positive were found in the present study among them three cases were microbiologically positive by CB-NAAT exam. Overall prevalence of adult pulmonary TB was found as 1083.3 per lakh population.

Conclusions: The overall prevalence of adult pulmonary tuberculosis in our study was much higher than the national average and it might be due to for delayed diagnosis of cases which leads to continuation of the transmission chain in the community.

Keywords: Adult pulmonary tuberculosis, Oil industry, Prevalence, Rural community

INTRODUCTION

Tuberculosis is a disease known since ancient times, still remains as a major public health challenge.¹ Tuberculosis is the number one cause of adult mortality among curable infectious diseases worldwide despite the availability of effective diagnostic, preventive and curative strategies against it.²

Periodic tuberculosis prevalence studies are necessary for assessing the performance of ongoing TB elimination programs. Community based prevalence studies helps to provide information for planning and assessing the trend of disease burden in different population and different

geographic areas.³ Prevalence of sputum smear positive TB can be measured accurately in population-based surveys though precision is influenced by large sample size is needed for diseases with low prevalence rate.

Periodic health camps organized by the Oil Industry Hospitals in its adjacent rural areas revealed that many pulmonary TB cases still remain undetected. These undetected cases maintain a chain of transmission in the community and remains as a challenge to the policy makers for disease containment and control. Very few prevalence studies on tuberculosis are available in recent times in our region particularly in rural setting near to an oil industry. So, keeping in mind the above conditions, it has been decided to conduct a cross-sectional study to

determine the prevalence of adult pulmonary tuberculosis among the rural community adjacent to the Numaligarh Oil Refinery and to assess the socio-demographic correlates of adult pulmonary tuberculosis in the study population.

METHODS

The present study was undertaken in the rural areas around the Numaligarh oil refinery to determine the prevalence of pulmonary TB. Numaligarh oil refinery is located at Marangi revenue circle in the Golaghat district of Upper Assam in the North Eastern Region of India. The present study is a community based cross sectional study done from July 2019 to June 2020 among the people residing in 24 revenue villages and six tea gardens adjacent to the NRL Township. The total population in the study area was 36,116, out of those population 23,454 people resided in revenue villages while 12,662 people resided in Tea Estates. For proportionate distribution 2,400 study participants were taken from revenue villages and 1,200 study participants were taken from tea garden areas.

Inclusion criteria

All those who had been residing for at least six months in the study area, those who were at least 15 years old, and those who had provided informed consent for participation in the study were included.

Sample size

Sample size was estimated by assuming a disease prevalence of 3.3% with a relative precision of 20 percent at 95% confidence level and design effect 1.25%.⁵ For non-response rate, 3% of calculated value was added and final sample size becomes 3,600. Stratified multistage random sampling method was adopted. The total population in the tea garden areas 12,662 and revenue villages were 23,454 respectively. For proportionate distribution 2,400 study participants were taken from villages and 1,200 study participants were taken from tea gardens. There are two PHC in the study area. Two sub-centers were randomly selected from each PHC and then three villages were selected from each selected sub-center randomly by lottery method and in this way 12 villages were selected. From each selected village 200 study participants were enrolled to meet the required number of study participants. In the Tea gardens, people are resided at different lines. Such two lines were selected from each three selected Tea Estates, total six lines were selected. From each selected line 200 study participants were enrolled in the study consecutively by doing house to house survey.

Data collection

For data collection in each selected village, first household was selected randomly and then consecutively

visited each and every household of the village till required number of study participant was achieved. At the household level all the individuals aged 15 years and above were enrolled after obtaining informed consent. A pretested predesigned semi-structured proforma was used for data collection. The socio-demographic details of all study participants were taken and they were asked for symptoms related with tuberculosis or any contact history of active pulmonary TB cases. The symptoms asked were cough for than 2 weeks, fever more than 2 weeks, presence of blood in sputum and recent history of significant weight loss. Participants who had any one of the above-mentioned symptoms of pulmonary TB (as per NTEP guidelines 2017) or contact history of active pulmonary tuberculosis were selected for sputum sample collection. Two sputum samples were taken from each of them. First samples were taken on the spot on the date of interview and for the second sample a sterile sputum container was provided to the study participant for self-collection of next morning sample in the next day and asked him to bring the sample to the nearest Designated Microscopy Centre (DMC). Three DMC were utilized for sputum smear examination namely DMC of VK-NRL Hospital, DMC of Marangi PHC and DMC of Bokakhat SDH as per patient convenience. In the cases of sputum smear negative patients, chest X-ray were done in the VK-NRL Hospital (free of cost) or Bokakhat SDH. Those who had reports suggestive of TB in chest X-ray, again sputum samples taken in falcon tube and were sent to Golaghat civil hospital for CB-NAAT examination.

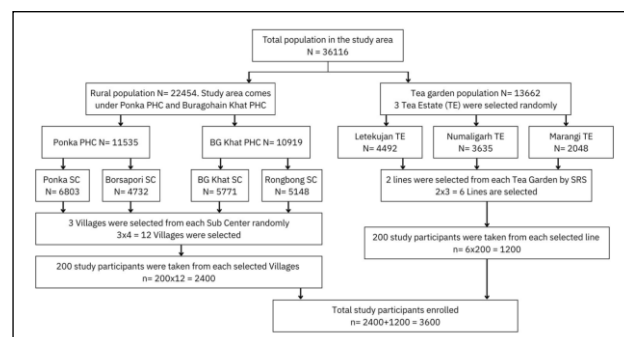


Figure 1: Study design.

RESULTS

In the present study out of 3,600 study participants were screened for symptoms of pulmonary TB where 318 presumptive PTB cases were identified. On sputum microscopy, 27 cases were found sputum smear positive for tuberculosis. The sputum smear negative cases (291) were further investigated with chest x-ray and 12 cases showed CXR suggestive of pulmonary TB (PTB). CXR suggestive of PTB cases (12) were further tested with CB-NAAT examination and among them only three cases are found to be microbiologically confirmed for TB. Out of the remaining 279 cases who were neither sputum smear positive for tuberculosis nor CXR suggestive of PTB, 67 cases were tested with CB-NAAT on high

clinical suspicion but none of them had positive results for tuberculosis.

It was observed that prevalence of PTB was more 35.9% in the age group of 35-44 years. We found that PTB was more prevalent among male 71.8% and 94.9% PTB cases were married. Highest PTB cases 59% cases were seen among TGL community. Most of the PTB cases (84.6%) were Hindu by religion. In educational status, it was shown that maximum 43.6% of PTB cases were educated up to lower primary classes followed by 30.8% cases were illiterates. By occupation tea garden labor had the major share of PTB 41% cases followed by 23.1% daily wage earners. Highest prevalence (48.7%) of PTB were found among people belongs to lower socio-economic class (class V) followed by in lower middle socio-economic class (class IV) according to modified BG prasad socio-economic scale 2020.

In this study it was found 39 cases of adult pulmonary TB was found among them 27 were sputum smear positive, three cases were detected by CB-NAAT exam while 9 cases had only CXR finding suggestive of TB. The overall prevalence of adult pulmonary TB was 1083.3 per 100000 population where prevalence of sputum smear positive TB was 750 per lakh population (Table 1).

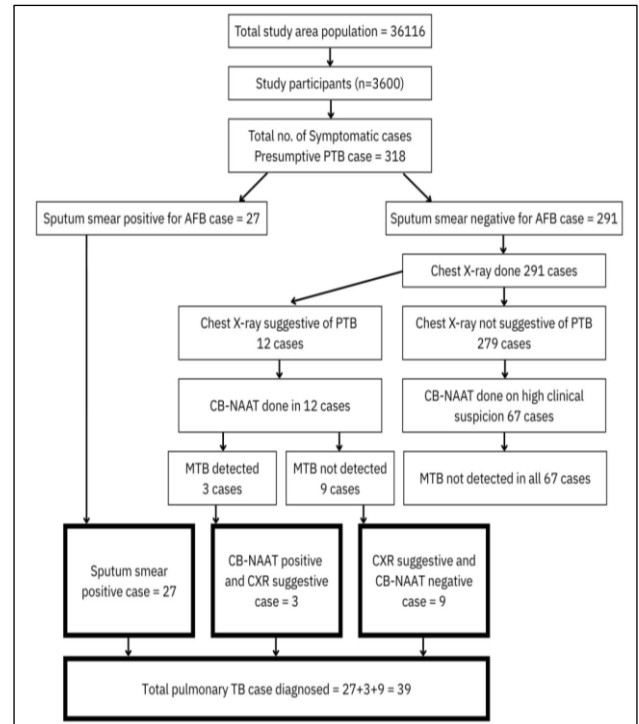


Figure 2: diagnostic algorithm.

Table 1: Prevalence of adult pulmonary according to mode of diagnosis.

Total population in the study area	Number of people screened for symptoms	Presumptive PTB cases	Sputum smear positive PTB cases	CXR suggestive PTB and CB-NAAT positive for MTB	CXR suggestive of PTB but MTB negative
36116	3600	318	27	3	9
Total adult pulmonary TB detected			39		
Bacteriologically positive adult tuberculosis			750/ 100,000 population		
CB NAAT positive and CXR suggestive adult TB cases			83.3/100,000 population		
CB-NAAT negative, only CXR suggestive TB cases			250/100,000 population		
Overall prevalence of Pulmonary TB			1083.3/ 100,000 population		

Table 2: Socio-demographic distribution of adult pulmonary tuberculosis.

Parameter	No of people screened for PTB	No of presumptive PTB cases identified	No of diagnosed PTB case	Prevalence of adult PTB per lakh population	P value
Male	1857	167	28	1500	0.01
Female	1732	151	11	630	
Married	2447	255	37	1510	0.001
Unmarried	973	48	2	210	
Christian	336	24	4	1190	0.783
Hindu	2972	275	33	1110	
Muslim	292	18	2	684	
General	857	33	4	467	0.05
OBC	726	34	8	1102	
SC	349	27	2	573	
ST	323	28	2	619	
Tea tribes	1345	196	23	1710	0.058
Graduate	93	2	1	1075	
High school	644	33	3	467	
ME school	1102	75	6	544	

Continued.

Parameter	No of people screened for PTB	No of presumptive PTB cases identified	No of diagnosed PTB case	Prevalence of adult PTB per lakh population	P value
Primary	979	88	17	1736	<0.0001
Illiterate	782	120	12	1535	
Service	109	9	1	917	
Business	259	14	4	1544	
Cultivator	605	32	2	331	
Daily wage	459	54	9	1960	
TGL	669	118	16	2157	
Unemployed	1519	91	7	627	

Table 3: Age wise prevalence of adult pulmonary tuberculosis.

Age group (in years)	No of people screened for PTB	Presumptive adult PTB cases	Diagnosed adult PTB cases	Prevalence of adult PTB (per lakh population)	P value
15-24	922	58	4	434	0.032
25-34	875	58	2	229	
35-44	639	67	14	2191	
45-54	588	71	12	2041	
55-64	341	34	3	879	
>65	235	30	4	1702	
Total	3600	318	39	1083	

DISCUSSION

According to annual report of India TB 2020, every year 199 new cases per lakh population are added to pool of tuberculosis in India.⁶ Studies conducted in different parts of India in the last two decades have shown a wide variation of prevalence of PTB ranging from 24 per lakh to 3294 per lakh population. A community based cross sectional study done by Rao et al in 2012-13 among Sahariya tribe in Gwalior district of Madhya Pradesh found overall prevalence of PTB to be 3294 per lakh population.⁵ Another cross-sectional study done at Mohali district of Punjab by Agarwal et al found the overall prevalence of 24.5 sputum smear positive pulmonary TB is 4.7% only.⁷ A cross sectional study done by Sharma et al estimated prevalence of PTB 101.4 per lakh population in Faridabad district, Haryana 2008-2009 while Dhanraj et al found overall prevalence of PTB 349 per lakh in 2010-12.^{8,9} Purty et al estimated overall prevalence of PTB 261 per 100000 where prevalence of new sputum smear positive PTB case was 58 per 100000.¹⁰ Our study finding of overall prevalence of PTB 1083.3 per 100000 was much higher than national average but within the range of different prevalent studies done in different parts of India. High prevalence of PTB cases in our study indicates that there many undiagnosed cases in the community and those cases silently transmit the disease to their close contacts maintain the chain of transmission. Although health facilities and free government services are available in that area, they were found to be underutilized by rural and tea garden people because of lack of awareness, which may be due to low literacy, lower socio-economic status.

It was observed that the prevalence of PTB was more than 35.9% in the age group of 35-44 years in comparison to 5.1% in the age group of 15-24 years (p value=0.032). Earlier studies done by Rao et al in Gwalior district of Madhya Pradesh found 27.7% and Sharma et al in Faridabad district of Punjab found 25% of total PTB cases in the age group of 35-44 years.^{8,11} This study finding of highest prevalence of PTB cases in the age group of 35-44 is statistically significant and supported by finding of earlier studies.

We found PTB is more prevalent among males 71.8% as compared to female 28.2% (p value 0.01). Numerous studies done across the country showed male preponderance with different male female ratios. Study done by Sharma et al in Faridabad district found 70% cases were male which almost similar with our study. Similar findings of male preponderance were seen in the TB prevalence studies done by Dhanraj et al 79.4%, Purty et al 66.7%, Saleem et al in Madurai 71.9%, Sinha et al 54.3%.¹⁰⁻¹⁴ On the contrary Alvi et al differ from our results with higher PTB cases 62.9% in females in comparison to 37.1% males.¹⁴ More prevalence of pulmonary TB among males may be because males are worked in inadequately ventilated, overcrowded conditions in industries like tea factories and usually takes extra responsibilities of their families ignoring their own health. Also habit of alcohol consumption and tobacco use are more in case of male in our study area which may be another reason for it. According to marital status, it was observed that adult PTB is more common among married (94.9%) than unmarried (5.1%). Similar finding of higher prevalence of PTB cases among married people was found in studies done by Saleem et al (75%), Javed et al in Punjab of Pakistan (75.6%), Adane et al

(60.1%), Senanayake et al in Sri Lanka (67.3%) and Zang et al in China (69.3%).^{12,13,15-17} This study finding of higher prevalence among married people is corroborated by finding of above-mentioned studies. Married people of productive age group have more liabilities as compared to unmarried people and therefore they could pay lesser attention to their own health.

In the present study highest prevalence of PTB (59%) was observed among tea tribes followed by 20.5% OBCs. Islam et al observed higher prevalence of 58.1% PTB among tea tribes in Jorhat district in a cross-sectional study on drug compliance of patients under RNTCP.¹⁸ The higher prevalence of PTB among tea tribes may be due to their lower socio-economic status, lack of higher education, poor housing and high consumption of alcohol and tobacco use. It also reflected the lack of adequate primary health care services as well as health seeking behavior among tea tribes.

In the present study, highest prevalence of adult pulmonary TB was seen in the age group of 35-44 years, more in males, among married people and most of them were Hindu by religion. Highest cases were belonging to lower socio-economic group, educated up to lower primary school and laborer of TE by occupation. Highest prevalence of 43.6% PTB cases were seen among the individuals educated up to lower primary class followed by 30.8% illiterates. This study finding of higher prevalence among people educated up to lower primary was supported by findings of Senanayak et al 46.3% in Srilanka, Zeng et al 36.71% in China.^{16,17} Due to lack of higher education most of the people were unaware about the disease transmission as well as early symptoms of tuberculosis.

It was observed in the present study that highest prevalence of PTB 48.7% was among subjects of lower socio-economic class followed by 32.2% in lower middle socio-economic class according to modified BG prasad socio-economic classification (updated 2019). Senanayake MGB observed that 75.1% PTB cases belongs to lower socio-economic class which is similar to our study while Ratta et al observed that 80% cases were from upper lower socio-economic class.^{16,18} In our study high prevalence of PTB was primarily due to lower socio-economic condition. This is substantiated by the finding of above-mentioned studies. Low income and lack of higher education is interrelated with other attributes of tuberculosis like overcrowding, lack of ventilation, large family size etc. The social determinants like poverty, malnutrition, hunger and poor housing conditions like overcrowding and inadequate ventilation in home and workplaces increases the likelihood of exposure to an infected person. Because of lower income, illiteracy, residential quarter with poor housing conditions along with the habit of regular alcohol consumption make tea garden laborer are more vulnerable to tuberculosis.

This study has few limitations. Usually in TB prevalence surveys large sample size is needed but due lack resource and constraint of time study was done with survey of 3600 study participant in a rural community adjacent to an oil industry. During the survey few extrapulmonary cases were found in the study population but those were not included in the study.

CONCLUSION

The overall prevalence of adult pulmonary tuberculosis was estimated as 1083.3 per lakh population in the study area which is much higher than the national average. Pulmonary TB prevalence is higher among the age group of 35-54 years especially among TGL. Low socio-economic status, lack of higher education and poor housing condition make them more vulnerable towards infectious diseases like tuberculosis which is further worsened by poor health seeking behavior. This might be the reason for delayed diagnosis of cases which leads to continuation of the transmission chain in the community.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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