Section: Respiratory Medicine

Original Research Article

PREVALENCE OF PULMONARY TUBERCULOSIS IN HEALTH CAMPS, DOOR TO DOOR SURVEYS, CONTACTS OF INDEX CASES AND AT NIKSHAY DIWAS IN TUBERCULOSIS UNIT OF RAMA MEDICAL COLLEGE MANDHANA KANPUR

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ABSTRACT

Background: Pulmonary tuberculosis (TB) is a major public health concern, especially in developing countries. Early detection is critical for effective treatment and reducing transmission. Community-based approaches such as health camps and door-to-door surveys can aid in identifying undiagnosed cases. **Objective:** To determine and compare the prevalence of pulmonary TB identified through health camps and door-to-door surveys in a selected population.

Materials and Methods: A cross-sectional study was conducted in TB Unit located at Rama Medical College-Hospital and Research Centre, situated in Kanpur Nagar. Screening was performed in two settings: health camps and direct household visits.

Results: A total of 207 index cases were screened. Door-to-door surveys identified more TB cases compared to health camps. Higher prevalence was observed in males aged 25–50 years. Common risk factors included smoking, undernutrition, and past TB history.

Conclusion: There is a significant hidden burden of pulmonary TB in the community. Door-to-door surveys were more effective in identifying TB cases than health camps. Community-based active case finding should be integrated into national TB control programs.

Keywords: Pulmonary tuberculosis (TB), Community-based approaches, Index Cases, Nikshay Diwas.

INTRODUCTION

Tuberculosis (TB) is a preventable and treatable disease, yet it remains a significant global health challenge. Despite concerted efforts by health organizations worldwide, TB continues to claim lives. In 2022, it ranked as the second leading cause of death due to a single infectious agent, second only to coronavirus disease (COVID-19).[1] The World Health Organization (WHO) has integrated tuberculosis into its Sustainable Development Goal (SDG) 3.3, which aims to eliminate the epidemics of AIDS, tuberculosis, malaria, and other neglected tropical diseases, while also addressing hepatitis, water-borne diseases, and other infectious conditions by 2030.[2]

Government health centers continue to play a pivotal role in reporting TB cases, although there has been a rise in case notifications from the private sector. In 2023, of the 25.5 lakh TB cases reported in India, approximately 8.4 lakh cases (33%) came from private healthcare providers, a significant increase from the 1.9 lakh cases reported by the private sector in 2015. This shift underscores the importance of collaboration between public and private healthcare systems to combat the TB epidemic effectively.

Nonetheless, TB remains a household-centered disease, and family members of TB patients, especially those with weaker immune systems or children, are at a higher risk of contracting the infection.[1]

Contact tracing and investigation, especially for active pulmonary TB cases, is a well-established practice in many high-income countries. This method involves identifying individuals who have had close contact with a TB patient, and testing them for signs of infection. Studies conducted in high-burden countries have shown that active case finding among household contacts leads to significantly more cases being identified than passive detection, where individuals seek medical attention on their own.[3] Contact tracing is a critical tool in controlling TB transmission. By identifying and testing people who have been in close contact with a TB patient, particularly in high-risk settings such as homes or healthcare facilities, health authorities can interrupt the transmission chain and treat cases before they develop into active TB. This is particularly important in settings where people may not seek medical care until symptoms are advanced, which increases the risk of further transmission.[4]

Active case finding takes this a step further by systematically screening at-risk populations outside health facilities, such as in communities or congregate settings like prisons or shelters. This approach often includes contact tracing, where people who have been in close proximity to someone with TB are identified and screened for the disease.[5]

Active case-finding (ACF) refers to a proactive approach in which health authorities actively seek out individuals with TB symptoms, rather than waiting for them to come to health facilities on their own. This strategy encompasses a wide range of activities, from public health campaigns to community mobilization and systematic screening of at-risk populations. Active case-finding is especially important for identifying TB cases in populations that may not recognize their symptoms or who, for various reasons, may not have access to healthcare services.[6]

One of the most effective forms of ACF is door-to-door surveys, where healthcare workers visit homes in the community to identify individuals who may have TB. This approach is particularly valuable in diagnosing TB in people who do not recognize their symptoms or those who may recognize the symptoms but are unable or unwilling to access healthcare facilities. Door-to-door surveys help to bring healthcare services to people in their own homes, thereby overcoming barriers such as distance, cost, or stigma associated with seeking TB care.[7] In addition to door-to-door surveys, health camps in high-risk or underserved areas can also be an effective strategy in TB control. These camps allow for mass screening, providing an opportunity to diagnose TB in individuals who may not seek medical help on their own. By diagnosing TB earlier in the disease course, these interventions can significantly reduce the time that an infected person remains infectious, thus lowering the overall transmission of TB within the community.[8] With above background this study was planned with primary goal of TB screening is to reach people who are not reached by the patient-initiated pathway and to detect TB disease at the earliest.

MATERIALS AND METHODS

This observational, cross-sectional study was conducted at the TB Unit located at Rama Medical College-Hospital and Research Centre, situated in Kanpur Nagar. This unit operates under the National Tuberculosis Elimination Program (NTEP) and serves as a key medical center for diagnosing and treating TB cases in the region. The target population consisted of patients diagnosed with pulmonary TB who were undergoing treatment or had been registered at the TB Unit during the study period.

Inclusion Criteria

"Household contacts" of Index Cases. They have been selected for intervention because they are close, most vulnerable and maybe most receptive to intervention. Definition of House hold contacts is a person who shared the same enclosed living space as the Index TB patient for one or more nights or for frequent or extended daytime periods during the three months before the start of current TB treatment.

"Age of household contacts ≥ six years": In a home setting, obtaining quality sputum samples from individuals under six years of age is not feasible. This is because they tend to swallow sputum instead of expectorating it.

Therefore, we included household contacts who were six years or older and could provide valid history, signs, and symptoms of P-TB during a verbal conversation with a doctor. They also needed to be able to provide a high-quality spontaneous sputum specimen for testing in home settings.

"At the home of the patient (index case)": We assumed that this would allow us to cover the maximum possible number of household contacts of the index case.

Exclusion Criteria-

Uncooperative

The family contact, has started living with index cases for less than three months and temporary visitors for short periods.

Sample Collection

In patients suspected of having pulmonary TB, two sputum samples will be collected: one early morning sample and one spot sample. These samples will be obtained using a sterile wide-mouth capped container for AFB examination and a conical 45 ml centrifuge tube (Falcon tube) for CBNAAT testing. This standardized collection method ensures the accuracy and reliability of both AFB examination and CBNAAT testing in diagnosing pulmonary TB.

Sample processing

The sample process involves multiple steps for comprehensive TB diagnosis and management.

Initially, a microscopic smear examination utilizing the ZN stain and culture on Lowenstein Jensen media (LJ media) will be conducted. Additionally, R-resistant TB (RR-TB) will be identified through CBNAAT testing. Patients testing positive for TB will undergo screening for HIV co-infection, with their blood samples analyzed using Rapid card tests. Furthermore, blood sugar levels will be measured using a glucometer to assess any diabetic conditions that may influence TB treatment outcomes.

Data were entered in Microsoft Excel and analyzed using SPSS version 23. Descriptive statistics were used to calculate frequencies and percentages. Clinico-pathological correlation was assessed using the Chi-square test, and a p-value ≤ 0.05 was considered statistically significant.

RESULTS

This section provides an in-depth analysis of the data collected from 207 index cases and their 496 household contacts. The results are presented systematically under the following categories: demographics and distribution, health and clinical characteristics, diabetes and TB prevalence, sputum and CBNAAT/TRUENAT diagnostic outcomes, contact characteristics, and environmental and risk factors. Each subsection includes detailed tables and figures for clarity and ease of understanding.

The demographic analysis of the index cases reveals important trends regarding the distribution of TB across age, gender, and residence. The total sample included 207 cases, with 130 males (62.8%) and 77 females (37.1%). The largest number of cases were observed in the 21–30 and 31–40 age groups, with 51 cases each, representing nearly half (49.3%) of the sample. In contrast, the 10–20 and 71–80 age groups had the least representation, with 15 (7.2%) and 5 (2.4%) cases, respectively. The mean age of the index cases was 37.4 years (SD = 11.5). Male participants were slightly older (M = 39.5, SD = 12.8) than females (M = 34.8, SD = 10.6).

Table 1: Age and Sex Distribution of Index Cases

Age Group (Years)	No of Males	No of Females	Total cases	Total cases
10–20	9 (6.9%)	6 (7.8%)	15(100%)	15(7.2%)
21–30	32 (24.6%)	19 (24.1%)	51(100%	51(24.6%)
31–40	30 (23.1%)	21 (27.3%)	51(100%)	51(24.6%)
41–50	25 (19.25%)	13 (16.9%)	38(100%)	38(18.3%)
51–60	17 (13.1%)	9 (11.7%)	26(100%	26(12.6%)
61–70	14 (10.77%)	7 (9.1%)	21(100%)	21(10.1%)
71–80	3 (2.30%)	2 (2.60%)	5(100%)	5(2.4%)

Health and Clinical Characteristics

The clinical presentation of TB cases showed variability in the duration of symptoms. The table 2 shows the distribution of cases based on the duration of illness. Most cases (67%; n = 139) reported symptoms lasting 1–6 months, while 28% (n = 58) experienced symptoms for 6–12 months. A small group (5%; n = 10) had symptoms for over a year, highlighting potential delays in seeking healthcare.

Table 2: Duration of Illness of Index Cases

Duration (Months)	Number of Cases	Percentage
1–6	139	67%
6–12	58	28%
>12	10	5%
Total	**207**	**100%**

Table 3: Age and Sex Distribution of Total Contact Cases

Age Group (Years)	Males (%)	Females(%)	Total cases	
10–20	40 (57.1%)	30 (42.9%)	70 (100%)	70(14.1%)
21–30	70 (58.3%%)	50 (41.7%)	120 (100%)	120(24.2%)
31–40	60 (60.0%)	40 (40.0%)	100 (100%)	100(20.2%)
41–50	50 (62.5%)	30 (37.5%)	80 (100%)	80(16.1%)
51–60	35 (63.6%)	20 (36.4%)	55 (100%)	55(11.1%)
61–70	20 (57.1%)	15 (42.9%)	35 (100%)	35(7.0%)
71–80	12 (54.5%)	10 (45.5%)	22 (100%)	22(4.4%)
Total	287 (57.8%)	209 (42.2%)	496 (100%)	496(100%)

Table shows that maximum contacts of index cases were in 21-30 and 30-40 years age groups. However, contacts were present in all age groups. The proportions of males and females in various age groups were almost similar.

Table 4. Sputum Positivity Status in Male and Female Index Cases

Gender	Sputum Positive	Sputum Negative	Total Cases	P-Value
Male	114 (87.7%)	16 (12.3%)	130 (100%)	**Chi-square=4.4 ‘p’=0.035**
Female	58 (75.3%)	19 (24.7%)	77 (100%)	
Total	172 (83.1%)	35 (16.9%)	207 (100%)	

This data shows the distribution of sputum-positive and sputum-negative cases based on gender. Among males, 87.7% are sputum-positive, while 12.3% are sputum-negative. For females, 75.3% are sputum-positive, and 24.7% are sputum-negative. The total number of sputum-positive cases is 83.1%, while sputum-negative cases account for 16.9%. The p-value of 0.035 indicates a statistically significant difference between genders, and the chi-square value of 4.42 suggests that the difference is unlikely to have occurred by chance.

Table 5: Distribution of Index Cases by CbNAAT/Truenat Sensitivity Pattern by Gender

Sensitivity Pattern	Males (%)	Females (%)	Total (%)
Sensitive	100 (94.3%)	65(94.2%)	165(94.2%)
Resistant	6 (5.7%)	4(5.8%)	10(5.7%)
Indeterminate	0 (0.0%)	0(0.0%)	0(0.0%)
Total	106 (60.6%)	69(39.4%)	**175(100%)**

Rifampicin sensitivity pattern was not different in Males and Females. These diagnostic findings emphasize the importance of advanced diagnostic techniques like CBNAAT for early detection and drug resistance profiling.

The table presents the distribution of positive cases by age group, showing the number of males and females, their respective percentages, and the total positive cases for each group. The highest percentage of positive cases is found in the 21–30 age group (27.6%), with 18 males (56.2%) and 14 females (43.8%). Males consistently represent a higher percentage of positive cases across all age groups, with a total of 56.9% of positive cases. The lowest number of positive cases occurs in the 71–80 age group (2.6%). Overall, the data indicates that positive cases are more prevalent in younger adults, particularly in the 21–40 age range.

Table 6: Age and Gender Distribution of House Hold Tb Contacts Testing Positive

Age Group (Years)	Males (%)	Females (%)	Total Positive Cases (%)	
10–20	10(58.8%)	7(41.2%)	17 (100%)	17(14.6%)
21–30	18(56.2%)	14(43.8%)	32 (100%)	32(27.6%)
31–40	15(53.6%)	13(46.4%)	28 (100%)	28(24.1%)
41–50	10(55.5%)	8(44.5%)	18 (100%)	18(15.5%)
51–60	7(63.6%)	4(36.4%)	11 (100%)	11(9.5%)
61–70	4(57.1%)	3(42.9%)	7 (100%)	7(6.0%)
71–80	2(66.6%)	1(33.4%)	3 (100%)	3(2.6%)
Total	66 (56.9%)	50 (43.1%)	**116 (100%)**	**116(100%)**

- **Males**: The mean age of male individuals testing positive for TB contact is approximately **35.91 years**.
- **Females**: The mean age of female individuals testing positive for TB contact is approximately **35.2 years**.
- **Total Positive Cases**: The overall mean age for individuals testing positive for TB contact across both genders is approximately **44.2 years**.

These mean age values suggest that the majority of TB contact positive cases fall within the **middle-aged range**, with males and females showing similar mean ages, but the total positive cases showing a slightly higher mean age.

DISCUSSION

The study revealed significant findings regarding the prevalence, diagnosis, and clinical impact of tuberculosis (TB). Among 207 index cases, males constituted 62.8% (n = 130), with a higher mean age (M = 39.5, SD = 12.8) compared to females (M = 34.8, SD = 10.6). The most affected age groups were 21–30 and 31–40 years, each contributing 24.6% (n = 51) to the total cases. This trend aligns with findings from similar studies that identify younger adults as particularly vulnerable due to high mobility, occupational exposure, and stress-related immune suppression. The economic impact of TB in this demographic is considerable, as illness-related productivity losses can exacerbate household financial instability. Targeted workplace screening and health education programs for this age group could mitigate the dual burden of economic loss and disease progression.

Diagnostic outcomes indicated that 83.1% (n = 172) of index cases were sputum-positive, with males having a slightly higher positivity rate (87.7%) than females (75.3%). Grading of sputum-positive cases showed moderate to high bacillary loads, with 34.9% graded as 2+ and 24.4% as 3+. Potentially reflecting advanced disease at the time of diagnosis or greater occupational exposure. Gender disparities in TB prevalence are consistent with global trends. The lower proportion of females could indicate underreporting due to stigma, caregiving responsibilities, or limited access to healthcare services. Addressing these disparities through gender-sensitive interventions, such as integrating TB screening into maternal and child health programs, could enhance detection and treatment rates among females.

These findings emphasize the need for targeted interventions, including enhanced diagnostic tools like CBNAAT, better management of comorbidities such as diabetes, and improved living conditions to reduce transmission. Public health measures must address delays in diagnosis, drug resistance, and the role of environmental factors to curb TB effectively. Delayed diagnosis was evident in 5% of index cases, where symptoms persisted for over 12 months before seeking care. Such delays increase disease severity and transmission risk. Barriers to timely diagnosis include stigma, lack of awareness, and inadequate healthcare access in rural areas. Community-based active case finding and enhanced training for healthcare workers to recognize early TB symptoms could significantly reduce diagnostic delays. Public health campaigns that normalize TB discussions and encourage symptom reporting can also play a critical role in addressing these barriers.

This study offers critical insights into the prevalence, diagnostic trends, and risk factors of pulmonary tuberculosis (TB) in health camp and door-to-door quarry settings. Pulmonary TB remains a major public health concern in our country, driven by multiple demographic, clinical, and environmental factors.

The study also found a higher TB burden among males (62.8%) with elevated sputum positivity (87.7%), compared to females (75.3%), suggesting delayed diagnosis and more advanced disease among males. Females may face healthcare access barriers due to stigma and caregiving roles. TB was most prevalent among the 21–40 age group, consistent with global data identifying this economically active group as high-risk. Urban predominance (58%) likely reflects better diagnostic access, while rural underreporting highlights the need for targeted outreach and diagnostic services.

Comorbid diabetes was observed in 17.9% of TB cases, with higher prevalence among males (19.2%), stressing the need for integrated TB–diabetes care. Diagnostic methods like CBNAAT/TRUENAT proved effective, identifying 6% rifampicin resistance, underscoring the importance of routine drug susceptibility testing.

CONCLUSION

In conclusion, this study highlights the multifactorial nature of TB, shaped by demographic, clinical, and environmental determinants. Addressing these factors through integrated, community-based, and gender-sensitive approaches is critical for effective TB control. Expanding access to diagnostics, improving living conditions, and addressing comorbidities like diabetes will be vital in reducing the burden of TB and achieving elimination goals. By targeting high-risk populations, addressing delays in diagnosis, and promoting preventive measures, TB programs can make significant strides toward mitigating the impact of this disease on vulnerable communities.

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