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## ORIGINAL ARTICLE

# Prevalence and Socio Demographic Factors of Tuberculosis Patients in Selected Slum Areas of Dhaka City

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**Abstract:**

***Background:*** *In Bangladesh WHO recommended DOTS has been provided free of charge since 1993, yet information on access to TB services by different population groups is not well documented and challenging especially in Urban Slum and hard to reach areas There is a gap and lack of information about TB services among the urban slum areas due to frequent migration of a large number of population.*

***Objectives:*** *The objective of this study was to detect prevalence and assess the socio demographic factors of actively detected cases from selected slum areas of Dhaka City.*

***Method:*** *This was a cross-sectional study which was conducted in several urban slum areas of Dhaka city. The household members were actively screened to assess the presence of TB-related signs and symptoms; cough e”3 weeks and body mass index (BMI) <17 kg/ $m^2$. Sputum specimens from suspects were collected for acid fast bacilli (AFB) microscopy.*

***Result:*** *Total 9,000 screened for pulmonary TB (PTB), Total 26 cases were detected of which 19 were positive for AFB on microscopy 06 were negative and 01 was child and the prevalence of new PTB cases was estimated to be 250/100,000. Out of 25 cases, 20(80%) had cough for several duration and 6(18%) did not present with cough at the time of screening. No multidrug resistant case was found. 50% percent of all TB cases had BMI <17 kg/m2 (p = <0.001). Out of 26 cases, 16 (62%) were male and 10 (38%) were female, with a ratio of 1.46"1; 20 (76%) were smear positive and the remaining 6 (24%) cases were smear negative.*

***Conclusion:*** *The study revealed high prevalence of TB in urban slums. Screening using low BMI can be beneficial among risk group population. It is important to conduct larger study to validate clinical variables like cough <3 weeks and low BMI to define TB suspect and also to investigate the transmission of TB in slum settings.*

***Key Words:*** *DOTS, Prevalence, Socio Demographic Factors.*

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## Introduction:

The global burden of Tuberculosis (TB) in 2010 is estimated to be 8.8 million in the form of incident cases, 12 million in the form of prevalent cases[1]. The incidence is estimated indirectly through notification of passively detected patients. The real burden of TB could be markedly higher if active case finding would be employed on larger scale than is now often done.

In many countries, differences in TB incidence between urban and rural areas have been described[2]. TB in urban areas often results specifically among certain urban risk groups, such as slum dwellers who are exposed to poor environmental conditions (overcrowding, poor living conditions)[3]. TB is still believed to be a disease that disproportionately affects the poor and marginalized[4].

The National Tuberculosis Control Program (NTP) of Bangladesh first adopted the directly observed treatment short course (DOTS) strategy in 1993. The program rapidly expanded in the following years to almost all areas of the country reaching 100% coverage in 2006[5]. There are still some gaps in the DOTS services provided for the urban slum dwellers. DOTS strategy is entirely based on passive case finding which is often influenced to a great extent by the treatment seeking behavior of the patients suffering from active TB, social stigmatization, access to health service and even diagnostic delay at health facility[6]. This in turn results in decreased TB case detection with underestimated number of actual TB cases prevailing in the community. Bangladesh had comparatively higher percentage (81%) of notified cases of pulmonary TB (PTB) that were sputum smear-positive (SS+) among the 22 high burden countries with TB [1]. Delay in the diagnosis of these open TB cases can result in transmission of TB among the contacts of the active TB cases and more likely to fuel its transmission in the community apart from increased morbidity and mortality[7].

The prevalence of SS+ TB was found to be higher in the rural population (86.0/100 000) compared to urban (51.1/100 000) in the recently completed (2007–2009) nationwide TB prevalence survey of Bangladesh[8]. A lesser number of cases in urban areas were also notified in the NTP in 2010 [9]. In 2010, the NTP notified a total of 158,709 of all forms of TB cases (103/100 000 population) nationwide of these 13% were reported from urban areas. However, there are still some pockets in urban area where TB notification rate believed to be higher. One of these is high burden settings like urban slums.

There are still major gaps in our epidemiological knowledge regarding the transmission dynamic of TB despite the fact that TB is endemic and highly prevalent in Bangladesh. Results from one of our previous studies performed in a rural community of Matlab showed that TB in rural Bangladesh is caused primarily by reactivation of latent infections, with the recent emergence of Beijing strain clusters[9]. Urban areas in Bangladesh are densely populated and about one third of the populations are slum dwellers, creating conditions where a high transmission can occur.

The aims of this study were to investigate the burden of active TB in an urban slum of Dhaka city with increased number of case detection based on active symptom screening. We also aimed to test the feasibility of a larger study to investigate TB transmission in this setting.

## Methods:

### *Study Setting:*

The study was conducted at a densely populated low income urban slum (Mohammadpur Slum) in Dhaka, Bangladesh Mohammadpur is one of the 40 thanas of Dhaka City with a population of about one million in an area of 55 square kilometers. We conducted the activities of this project in several slums including Geneva Camp Slum. The population of these slums is approximately 45,000. These slums are inhabited by poor and lower class families, residential and sanitary conditions are typical of any congested urban settlement.

### *Study Procedure:*

This cross-sectional house-to-house survey was conducted from July 2009 to June 2010. Individuals not present at the household during the first house visit were attempted to be included on at least one subsequent visit. The team consisting of two trained field workers and one research assistant visited the study area on a daily basis and screened them for TB symptoms using simple standardized questionnaires. The socio-demographic characteristics, history regarding TB symptoms and other relevant information were collected from the consenting participants. Individuals having productive cough for three or more weeks with or without other clinical presentation were identified as suspects for PTB. We also considered a body mass index (BMI) <17 kg/m$^2$ as a single inclusion criteria for the study as one of our previous study showed more likelihood of developing TB among individuals with BMI<17[10]. Three sputum specimens from each PTB suspect were collected by the field worker after further clinical evaluation of the suspects by the research assistant. The first sputum specimen was obtained immediately after identifying the subject as suspect. The second specimen was overnight sputum collected on the next morning and the third was spot during collection of the second sputum specimen. PTB suspects who did not provide consent to provide sputum specimens in the study were re-invited at least once. The specimens were immediately brought to Shyamoli Tuberculosis Laboratory in a cool box for acid-fast bacilli (AFB) microscopy.

**Laboratory Investigations:**

Concentrated sputum smears were examined for AFB using the Ziehl-Neelsen staining under light microscope. Sputum specimens were decontaminated following the Petroffs' NaOH method.

**Case definitions for TB disease:**

The diagnosis of TB was made according to the case definition given by the NTP depending on the site and bacteriological status.SS+ PTB was defined as a positive sputum smear confirmed with a second positive or chest radiological X-ray abnormalities consistent with active TB; and smear negative PTB was defined by two positive cultures of *M. tuberculosis* while three sputum specimens negative for AFB.

**Epidemiological investigation:**

Clustered patients were investigated to further establish or strengthen potential epidemiological connections in place, time, and person among cluster members. Participants were being considered to share a strong epidemiological link if they would have had been in the same workplace, household, village or area at overlapping times (even a known single exposure to patients).

**Statistical analysis:**

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 17.0. Univariate analyses were performed to examine the association between demographic and clinical variables of TB cases. $P$<0.05 was considered as evidence of significant difference[11] To identify the independent risk factors for TB and non TB, adjusted odds ratio (AOR) and 95% CI were calculated by logistic regression analysis.

**Results:**

A total of 3700 households were visited and 16,500 eligible participants belonged to those households; of them 15,000 (90%) consented subjects were screened during 12 month period. Of these 9,800 (66%) were aged 15 years or more (adults) and 5,200 (34%) were aged below 15 years (children) (Table 1). Out of 1431(14% of 9,000) adult PTB suspects, sputum specimens were collected from 618 (43%) suspects. Majority (87%) of these suspects who were unable to provide sputum specimen were initially identified as a suspect because of their low BMI even in the absence of cough for any duration. Among the child population, 36 child suspects were identified and sputum smear microscopy and relevant tests were performed in 29 child suspects (Figure 2). We have detected 26 (4% of 647 suspects) TB cases during this time period. Out of 26 cases, 16 (62%) were male and 10 (38%) were female, with a ratio of 1.66"1. Only one child TB case was diagnosed. Out of the 25 adult TB cases identified in our study, 19 (76%) were smear positive; and the remaining 6 (24%) cases were smear negative but showed growth in culture. The estimated number of new pulmonary TB cases (AFB and/or culture) was 253/100,000 population and the estimated number of new SS+ TB cases was 192/100,000 populations; among the subjects aged ≥15 years, who participated in the study. All 26 identified PTB cases were brought under treatment by DOTS program.

**Table-I**
*Characteristics of study population*

| Variables | | Study population | | | |
|---|---|---|---|---|---|
| | | All screened (n = 15024) | TB (n = 26) | Non-TB (n = 14998) | |
| Category | Sub categories | Number (%) | Number (%) | Number (%) | p Value |
| Demographics | | | | | |
| Sex | Male | 6757 (45.0) | 16 (61.5) | 6741 (44.9) | 0.09 |
| | Female | 8267 (55.0) | 10 (38.5) | 8257 (55.1) | |
| Age | 0–14 yrs | 5151 (34.3) | 1 (3.8) | 5150 (34.3) | <0.001 |
| | 15–24 yrs | 3739 (24.9) | 7 (26.9) | 3732 (24.9) | |
| | 25–34 yrs | 2601 (17.3) | 4 (15.4) | 2597 (17.3) | |
| | 35–44 yrs | 1665 (11.1) | 4 (15.4) | 1661 (11.1) | |
| | 45–54 yrs | 926 (6.2) | 6 (23.1) | 920 (6.1) | |
| | 55–64 yrs | 553 (3.7) | 2 (7.7) | 551 (3.7) | |
| | 65+ yrs | 389 (2.6) | 2 (7.7) | 387 (2.6) | |
| Occupation* | Self-employed | 1681(17.0) | 10 (40.0) | 1671 (17.0) | 0.02 |
| | Business | 481(4.9) | 2 (8.0) | 479 (4.9) | |
| | Service | 2490 (25.2) | 5 (20.0) | 2485 (25.2) | |
| | Unemployed | 1982 (20.1) | 5 (20.0) | 1977 (20.1) | |
| | Housewife | 3236 (32.8) | 3 (12.0) | 3233 (32.8) | |
| Smoking | No | 14346 (95.5) | 19 (73.1) | 14327 (95.5) | <0.001 |
| | Yes | 678 (4.5) | 7 (26.9) | 671 (4.5) | |
| Symptoms | | | | | |
| Cough | No | 14488 (96.4) | 5 (19.2) | 14483 (96.6) | <0.001 |
| | Yes | 537 (3.6) | 21 (80.8) | 516 (3.4) | |
| | <2 weeks | 157 (29.2) | 1(4.8) | 156 (30.2) | 0.02 |
| | ≥2 weeks <3 | 47 (8.8) | 3 (14.3) | 44 (8.5) | |
| | ≥3 weeks | 333 (62.0) | 17 (81.0) | 316 (61.2) | |
| Haemoptysis | No | 14989 (99.8) | 24 (92.3) | 14965 (99.8) | <0.001 |
| | Yes | 35 (0.2) | 2 (7.7) | 33 (0.2) | |
| Evening rise of temperature | No | 14898 (99.2) | 14 (53.8) | 14884 (99.2) | <0.001 |
| | Yes | 126 (0.8) | 12 (46.2) | 114 (0.8) | |
| Chest pain | No | 14847 (98.8) | 19 (73.1) | 14828 (98.9) | <0.001 |
| | Yes | 177 (1.2) | 7 (26.9) | 170 (1.1) | |
| Shortness of breathe | No | 14884 (99.1) | 11 (42.3) | 14873 (99.2) | <0.001 |
| | Yes | 140 (0.9) | 15 (57.7) | 125 (0.8) | |
| Risk factors | | | | | |
| Previously diagnosed as TB | No | 14784 (98.4) | 17 (65.4) | 14767 (98.5) | <0.001 |
| | Yes | 240 (1.6) | 9 (34.6) | 231(1.5) | |
| Exposure to TB patient | No | 13991 (93.1) | 25 (96.2) | 13966 (93.1) | >0.1 |
| | Yes | 1033 (6.9) | 01 (3.8) | 1032 (6.9) | |
| BMI* | BMI (e"17.0) | 8676 (87.8) | 12 (48.0) | 8664 (87.9) | <0.001 |
| | BMI (<17.0) | 1201 (12.2) | 13 (52.0) | 1188 (12.1) | |

All value are n (%). p values are comparing TB patients (n = 26) against no. no-TB (n = 14998).
*Occupation and BMI were calculated among the adult group only;
Fisher exact test are shown in boldface font.

A number of clinical variables were assessed for an association with TB in this study. Out of 26 diagnosed cases; 21(81%) had cough and 5(19%) did not present with any cough at the time of active screening, they were suspected on the basis of their poor nutritional status (Table 1). Malnutrition, as defined by low BMI (<17 kg/m$^2$), was also associated with TB; this can either be a risk factor or result of TB. Fifty two percent of all TB cases had BMI <17 kg/m$^2$ (p=<0.001) (Table 1). Thirty five percent of the identified TB cases had a previous history of TB (p = <0.001). Other clinical variables which were associated with TB were fever, haemoptysis, chest pain and shortness of breath (not statistically significant). No significant association was observed between TB and diabetes mellitus, exposure to TB patients, and alcohol consumption. After adjusting for confounding factors, a risk factor analysis showed that a higher likelihood of developing active TB was associated with smoking, previous history of anti-TB treatment & low BMI (Table II)

**Table-II**

*Odds ratios (ORs) for TB by Socio Demographic characteristics and Potential risk factors.*

| Variables | | Unadjusted | Adjusted | | |
|---|---|---|---|---|---|
| Category | Sub categories | OR (95% CI) | *P* Value | AOR (95% CI) | *P* Value |
| Socio demographic | | | | | |
| Sex | Female | 1.00 | | | |
| | Male | 1.960 (0.9 – 4.3) | 0.09 | | |
| Age | 0–14 yrs | 1.00 | | | |
| | 15–24 yrs | 9.7 (1.2–78.5) | 0.03 | | |
| | 25–34 yrs | 7.9 (0.9 –71.0) | 0.06 | | |
| | 35–44 yrs | 12.4 (1.4–111.0) | 0.02 | | |
| | 45–54 yrs | 33.6 (4.0–279.3) | 0.001 | | |
| | 55–64 yrs | 18.7 (1.7–206.5) | 0.01 | | |
| | 65+ yrs | 26.6 (2.4–294.2) | 0.007 | | |
| Occupation* | Self-employed | 1.0 | | | |
| | Business | 6.4 (1.8 – 23.4) | 0.005 | | |
| | Service | 4.5 (0.8 – 26.9) | 0.10 | | |
| | Unemployed | 2.2 (0.5 – 9.1) | 0.29 | | |
| | Housewife | 2.7 (0.7 – 11.4) | 0.17 | | |
| Smoking | No | 1.0 | | 1.0 | |
| | Yes | 7.9 (3.3 – 18.8) | <0.001 | 3.7 (1.5– 9.3) | 0.005 |
| Risk factors | | | | | |
| Previously diagnosed as TB | No | 1.0 | | 1.0 | |
| | Yes | 33.8 (14.9 –76.7) | <0.001 | 15.7(6.6–37.3) | <0.001 |
| BMI* | BMI (e”17.0) | 1.0 | | 1.0 | |
| | BMI (<17.0) | 7.9 (3.6–17.4) | <0.001 | 5.3 (2.3–12.0) | <0.001 |

OR = odds ratio; AOR = adjusted odds ratio; CI = confidence interval; adjusted odds ratio are not presented for variables with *P* values more than 0.1; * Occupation and BMI were calculated among the adult group only.

Out of 26 cases, DST was done on 20 strains of *M. tuberculosis* available. Five cases were not available (one was unable to produce valid culture result, two started anti-TB treatment before collection of specimens for culture, one specimen was missing for culture and the child TB case was negative on culture) for DST and another one was excluded from the analysis as it was non tuberculosis mycobacterium (NTM) strain. One (5%) strain was resistant to streptomycin alone and 1 (5%) was resistant to all four drugs. The remaining 18 (90%) strains were susceptible to first line drugs. The DR-TB case was notified to the NTP for subsequent management.

## Discussion:

There is lack of data on the prevalence of TB in urban slums of Bangladesh. According to the recently completed national TB prevalence survey in Bangladesh, the prevalence of new SS+ TB was estimated to be 79.4 per 100,000 and the prevalence rate for urban area was 51.1 per 100,000[12]. Whereas our study, conducted in an urban slum area, revealed high prevalence of TB which is more than two times higher than overall prevalence and nearly four times higher than the prevalence in urban settings[13-15].This study has provided insight into the prevalence of TB, increased the case detection and identified some of the contributing factors for increased rate of SS+ PTB in a densely populated urban slum in Bangladesh.

This study also showed that active case finding for TB in urban slum setting is effective, given the high rate of participation, the feasibility of timely transportation of collected specimens to the central laboratory (no contamination), as well as laboratory testing which were used to investigate the TB burden along with molecular epidemiology of TB in settings like an urban slums[16-20].

The study results of our study indicate that clinical variables like cough <3 weeks and low BMI should be considered for suspecting TB cases and these issues should be addressed in the current NTP guidelines and awareness campaign which usually addresses only those with cough for at least three weeks[21]. This could eventually detect those masked TB cases without cough or cough for less than three weeks duration[22-24]. According to existing NTP guidelines in Bangladesh a patient is not suspected to have TB unless the patient has been coughing for three or more weeks[25]. The gap of this current criteria poses the risk that we might be missing quite a large number of TB cases. Our study indicates that pulmonary TB with a history of cough is not significantly less frequent, when duration of cough is shorter than three weeks[26-28]. This observation was also done in the prevalence study where the majority of TB cases identified did not have a history of cough[29-30]. One of the recent studies also presents the data with relevance of duration of cough and TB in line with our findings[31-32]. Several studies in the past showed an association between malnutrition and TB[33,34,35] and in one of our previous studies in prison we confirmed that in the prison population in Bangladesh[36]. The presence of low BMI in such a population is an important screening indicator of the disease in this population. However, more research with larger population should be performed to support these findings among different population group of Bangladesh[37].

In our study, among the detected cases the male-female ratio was 1.66"1. In recently completed prevalence survey, TB in males was three times higher than females. Among the adult population a higher male: female ratio has also been found in data from the NTP report . However, we cannot comment whether TB is more common in men or we have missed the women with TB due to their perceptions of TB, denial about the suspicion of having TB related with social stigma or their ability to produce quality sputum specimen. It is evident that, women experienced longer delays in help seeking for TB at different stages of the disease ccompared with men[38]. There is definite need of study addressing gender differences in TB diagnosis and treatment to see the gender variations in treatment seeking behaviour in the community.

One of the objectives of our study was to characterize those strains that caused TB in an urban slum of Bangladesh and to investigate the extent of transmission. However, it is difficult to draw a conclusion from our study results as we have smaller numbers of detected cases and the study period was short to observe the transmission pattern . A relatively higher proportion (20%) of our *M. tuberculosis* isolates were clustered during this short study period compared to 11% cluster in our previous study in the rural community[38]. There was no apparent epidemiological link among the clustered cases. However, there is every possibility of recent transmission of TB among the infected persons considering the fact that this study was performed in an urban slum which was overcrowded and congested[39]. Interestingly, the clustering was found among the younger age group (mean age 29; range: 19–40 yrs) which also favours recent transmission . It might not be possible to find the index case but considering the TB incubation period ranging from few months to few years there is possibility of recent transmission. It is important to determine whether TB disease has resulted from recent exogenous infection/reinfection or endogenous reactivation of a long-term latent infection to have an effective TB control measure strategy [40]. The results showed that it is feasible to conduct this transmission study in urban slum settings and being a high burden country, Bangladesh warrants these transmission dynamic studies in larger scale.

One of the limitations of our study was the purposive selection of Mirpur urban slum. This was selected as the area had been used as field sites for different studies conducted by icddr,b and we have a harmonious relationship with the population of the study area. We have not taken the HIV status into consideration as the prevalence of HIV in Bangladesh is low (less than 1%). Another reason for not taking the HIV status into consideration was the requirement of voluntary counseling prior asking the patient about the HIV status, which was difficult in active screening based field study. However, we believe that the interpretation of results in our study has not been influenced by the HIV status. It is important to conduct a prospective study with a larger sample size in the urban slum settings to estimate the prevalence of TB and its transmission in this high risk group . The current study identified areas in which design and data collection can be strengthened. It will be interesting to understand and know how the programmatic factors like screening only for chronic cough (less sensitivity), diagnosis by sputum smear microscopy (<70% sensitivity), others (services, human resource, quality etc.) and non-programmatic factors like care seeking, private sector, socioeconomic status etc.affecting detection of SS+ TB cases in urban improvised areas[40]. This system bypass or non use of or non-detection by DOTS is important and should be addressed particularly with the growing threat of HIV infection and drug resistant TB in the country.

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