HIV Sero-Prevalence among Tuberculosis Patients in Bangladesh: A nationwide cross-sectional study

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Abstract

Introduction

Bangladesh is committed to achieving the SDG target of ending the tuberculosis epidemic and achieving UHC by 2030. To inform policy and program decision-making, this nationwide sero-survey of HIV among tuberculosis patients was conducted.

Methods

The cross-sectional survey utilized a two-stage probability proportional to size (PPS) systematic random sampling technique for selected TB reporting centers (TRCs) from June 2020 to December 2021. The estimated 12,065 diagnosed tuberculosis patients, according to the NTP diagnostic algorithm, irrespective of age and sex, were included. The required information was collected through face-to-face interviews and record reviews using a pre-tested electronic TAB-based semi-structured questionnaire. With all aseptic precautions for all respondents who gave consent, 5 ml. venous blood was collected for the standard confirmatory test by 4th generation ELISA method for detection of antibody of HIV1/2/P24 antigen.

Results

Out of 12,065 TB patients surveyed, most of them were from the Dhaka division (25%), urban (76%), 55 years and above (28%), male (56%), married (82%), illiterate (36%) and living in a nuclear family (70%). A total of 12 (0.1%) HIV-positive cases were found among TB patients across the country, and the majority (33%) of them belonged to the age group of 35 to 44 years, male (58%), lower educational group (67%), urban resident (67%), and from nuclear family (77%). The HIV-positive patients found more among pulmonary TB patients (83%) who were detected bacteriologically positive (58%) but smear and gene expert negative (75%). Among them, none was found to have progressed to drug-resistant TB.

Conclusion

HIV affects the immune system, and TB is one of the leading causes of death in HIV-infected people. Although the rate is low, there is a need for continued efforts to prevent and treat TB in Bangladesh, particularly among older age groups, urban residents, and those with co-morbidities such as diabetes.

Keywords: Prevalence; Human immunodeficiency virus; Tuberculosis; Sero-survey; Bangladesh.

Introduction

Tuberculosis (TB) is a serious public health concern, ranking among the top 13th causes of death globally due to a single infectious agent [1]. In 2018, 10 million global people were diagnosed with TB, with men, women, and children being affected equally [2]. People living with HIV accounted for 9% of TB cases, and there were 160 new and recurrent cases reported per 100,000 people [1,2]. Despite progress in reducing TB deaths, an estimated 47,000 deaths occurred in 2018 [3]. In Bangladesh, a low-middle-income country with a population density of 1,115.62 people per square kilometre, 357,000 individuals were diagnosed with TB, with 90,000 cases remaining undiagnosed or unreported [4,5]. HIV is one of the top five risk factors for TB in Bangladesh, with 730 (360-1200) people living with TB/HIV, of which only 67 cases were reported in 2018 [1,5].

Global scenario

Globally, tuberculosis and HIV co-infection is a significant health concern as it negatively impacts the outcome of both diseases [6,7]. TB is an opportunistic infection that is more prevalent in people with weakened immune systems, increasing the risk of TB in people with HIV. Infection with both HIV and TB is called HIV/TB co-infection, as suggested by numerous literatures [6-10]. TB-HIV co-infection can vary from 0-15% reported in a study conducted on the people of the European Union [6]. The risk factors for TB/HIV co-infection include sex, age, smoking, intravenous drug use, CD4 count at HIV diagnosis, and HIV transmission route [6,11,12]. However, improving early detection of TB/HIV co-infection can improve treatment outcomes [8,13]. In many countries, monitoring HIV levels in TB patients is important to address the spread of HIV and provide comprehensive care to those with TB/HIV.

Bangladesh perspectives

Bangladesh has achieved significant improvements in the public health sector through the reduction of child mortality, improvement of geriatric health, control of communicable and non-communicable diseases, and effective management of the deadly COVID-19 pandemic [14-20]. According to the SDGs set forth for Bangladesh, Goal 3, Target 3.3 aims to put an end to the outbreaks of AIDS, tuberculosis, malaria, and neglected tropical diseases by the year 2030 [21]. The diagnosis of HIV in TB patients is a challenge as a low-level epidemic, particularly in areas with limited access to healthcare and needs to prioritize the integration of TB/HIV services [22]. Previous studies indicate that the overall HIV prevalence in Bangladesh is less than 1% among most at-risk populations [23-27].

The absence of nationally representative information on the prevalence of HIV among tuberculosis patients is a critical issue in fulfilling the growing commitment to

provide comprehensive HIV care, including antiretroviral therapy (ART), to individuals who are both HIV-positive and suffering from tuberculosis [25]. Testing for HIV in TB patients and their contacts often results in a high number of new diagnoses. However, often, the treatment is not offered or taken up. In Bangladesh, TB care and treatment services are integrated into the primary healthcare system, but only 17% of the estimated number of TB patients living with HIV receive ART [28]. The National AIDS/STD Program (NASP), within the Directorate General of Health Services (DGHS) of the Ministry of Health and Family Welfare (MoHFW), acts as a nodal body responsible for programming to address HIV issues in the country [26]. According to WHO regional health statistics, the number of new HIV infections was 0.01 per 1,000 uninfected population and has been stable since 1990 [29]. The National TB Control Program in Bangladesh works closely with other organizations to provide high-quality, integrated TB care and prevention [26].

The country is among the world's 30th highest TB burden countries and needs information about its HIV epidemic to combat its spread [30]. This study conducted a nationally representative sero-survey to determine the prevalence of HIV infection among tuberculosis patients in Bangladesh. The study is crucial for Bangladesh to fulfil the target of the Sustainable Development Goals and increase service coverage to achieve Universal Health Coverage.

Methods

Ethical Clearance and permission of Data Collection

Ethical approval for the study was obtained from the Institutional Review Board of Bangladesh Medical Research Council (BMRC), with registration number BMRC/NREC/2019-2022/993. A brief introduction to the aims and objectives of the study was given first. Then, the written consent translated into the native language was read to illiterate tribal elderly. All collected data was kept anonymously. The design and delivery of data collection for this study continuously tried to ensure the enrolled population's rights to privacy, confidentiality, informed consent and freedom of movement. The information was kept with the highest confidentiality and was used only for this study, and privacy was maintained during data collection. The participants were given full freedom to withdraw their consent to participate at any stage of the study. The national TB program was also proactively engaged, empowering patients in study design, data collection, and service delivery to accountability.

Study setting, population, and pre-testing

This cross-sectional survey study was conducted from June 2020 to December 2021. In this design, data was collected through interviews, a questionnaire, document review, and blood sample collection. According to 1st and 2nd quarter 2020 data, a total of 100163 patients are getting treatment registered under 857 countrywide TRCs. So, the target population for this survey includes all patients suffering from tuberculosis and registered under the TB reporting centre of the National Tuberculosis Control Programme (NTP) from 1st quarter to 3rd quarter of 2020, including new diagnoses. Pre-testing was conducted by six (06) teams at the end of September 2020. A total of 81 respondents' data and biological samples were collected. Response rates were 35% in urban centres while only 100% in rural centres during pre-testing. All the samples were found to be negative for HIV.

Data Collection Technique:

After getting verbal and written consent, data was collected by trained laboratory technicians from the participants by face-to-face interviews through TAB based pre-tested, semi-structured questionnaire. For the HIV test, blood was collected from the participants by following standard guidelines, and the sample was tested at the laboratory of the National Institute of Preventive and Social Medicine.

Team composition

The technical committee of the survey consisted of one principal investigator, two co-principal investigators and thirteen co-investigators. Besides these, one finance and budget officer, one administrative officer, one research officer, two quality control officers, one statistician, ten field supervisors (Public Health Background) and thirty data enumerators (MT lab technician/phlebotomist) were recruited for the survey.

Training of Field Supervisors and Data Enumerators

Training of field supervisors and data enumerators was conducted in September 2020. All the training sessions were conducted by esteemed investigators, project officials, and other resource persons. The training ensured a common understanding of the terms and definitions used in the survey manual and ensured accurate data collection, tab management and good data quality. On the closing day, a feedback session about the questionnaire was arranged where the Line Director of NTP and Director of NIPSOM (Principal Investigator) graced the session.

Variables included in the study

Variables in this study were the socio-demographic variables [Age, Sex, Religion, Marital status, Education, Occupation, Family type], Co-morbidities [Diabetes, Hypertension, Kidney diseases, COPD], History of transfusion/infusion, History of any major or minor surgery, Past history, History of previous TB treatment, H/O contact with TB or HIV patients, Diagnosis-related variables, Process of TB-HIV co-infection diagnosis, Magnitude of TB-HIV co-infection in the catchment area, Notification process of TB-HIV co-infection, TB-HIV integrated service-related variables, and vulnerable group for TB-HIV co-infection according to focal persons. Respondents' HIV sero-prevalence was observed by collecting blood samples.

Selection Criteria

Inclusion Criteria were diagnosed tuberculosis patients according to the NTP diagnostic algorithm irrespective of age and sex. Participants who provided informed written or verbal consent were included in the study. The target population of the study included individuals residing in all geographical areas of the country. As this survey was under NTP, the exclusion criteria were tuberculosis patients not enrolled under NTP and patients declared as cured/treatment completed.

Sample size estimation

From general theory, the minimum required sample size is determined using the usual sample size determination formula for estimating proportion with a relative margin of error, which is given by:

$$n = \frac{n_0}{1+\frac{n_0}{N}} \times deff, (1)$$

$$\text{with } n_0 = \frac{z^2 p(1-p)}{d^2} (2)$$

Where "p" represents the prior estimated proportion of the desired characteristics in the population, "z" represents the value of a standard normal variate that provides a 100α% chance of obtaining a poor sample, "d" represents the acceptable relative margin of error, "N" is the total population size, and "deff" represents the design effect used in complex surveys that employ multi-stage cluster sampling.

Here, we have considered p = 0.001 (according to a survey of NTP, the estimated proportion of HIV among TB patients is 0.1% [25]), q = (1-p) = 0.999, z = 1.96 and d = 0.0006 (at 0.06%). From the 2019 Annual TB report, N= Total number of TB patients in a year= 100163. Considering a 10% unavailability in the course of the study time, we have N=0.9X100163= 90488. We consider design effect=1.25.

As a result, the required sample size becomes

$$n_0 = \frac{z^2 p(1-p)}{d^2} = \frac{1.96^2 \times 0.0001 \times (1-.0001)}{0.0006^2} = 10660.$$

$$\text{Hence } n = \frac{n_0}{1+\frac{n_0}{N}} \times deff = \frac{10660}{1+\frac{10660}{90488}} \times 1.25 = 11920 = 12000(appx).$$

The data from the first and second quarter of 2020 revealed that 100,163 patients received treatment at 857 Treatment and Recovery Centers (TRCs) across the country. After evaluating the current situation and patient recovery rate from the first quarter, it was determined that the number of patients would decrease by 10%. Based on this estimation, the expected number of patients at the field was 90,146, and the sample size was calculated to be 11,920. The final sample size was estimated to be approximately 12,000.

Sampling techniques

The survey was performed by probability-to-proportion sampling in two stages.

Stage I: Selection of TRC from 64 districts was done by probability proportion sampling (PPS) based on the list of TRCs all over the country as primary sampling units. For the first stage of PPS systematic sampling, we first determined the number of centres to be selected, assuming an average of 50 patients from each centre. In the second stage, we need 238 centres. Since in PPS systematic sampling, some centres may have missed out on the selection; we started with a 10% higher number of centres, which is 263. Attempting 263 centres, the PPS systematic sampling ended up selecting 253 centres.

Stage II: The selection of the sample patients was made through systematic random sampling from the selected TRCs, maintaining sample sizes proportional to the number of patients listed under the centre. At the same time, the second stage sampling frame was the patients' registration records. Patients were selected systematically from each TRC with an interval of 4. Neither replacement nor changes of the pre-selected TRC or patient were allowed at the implementing stage to prevent bias.

Pre-testing

Pre-testing was conducted by six (06) teams in three rural TRCs (Savar Upzilla Health Complex (UHC), Dhamrai UHC, Dhaka Export Processing Zone DOTs centre) and three from urban (Malibag BGME TRC, Lalbag TRC and Naare Maitri TRC, Mohakhali, Dhaka). Each team consists of three data enumerators led by one supervisor and two co-investigators. A total of 81 respondents were observed in pre-testing, with a response rate of 65% in urban centres and 100% in rural centres. All the samples were found to be negative for HIV. The questionnaire was then corrected and modified according to the findings after pre-testing.

Data collection

A trained data enumerators team was employed in data collection. Data was collected through face-to-face interviews using a pre-tested electronic TAB-based semi-structured questionnaire. A document review was done to collect treatment and investigation-related data. To observe the HIV prevalence, blood samples were collected from 12065 participants after getting their consent and were tested at NIPSOM LAB. Maintaining cold chain and taking all aseptic precautions for all respondents who gave consent, 5 ml. venous blood was collected to test HIV, upholding the standard confirmatory test by 4th generation ELISA method for detection of antibody of HIV1/2/P24 antigen. External quality assurance was done on all positive samples and 1% of negative samples in the HIV reference laboratory. Proper aseptic precautions were taken, and all the samples were coded properly during blood sample collection. The whole data collection process was supervised by the trained supervisor, and the technical committee visited the data collection field frequently to ensure valid data collection. The collected data was processed in the central office, NIPSOM, for authenticity, consistency and relevancy.

To prevent any unwanted harm or complication during the sample collection and waste management, all the phlebotomists were trained extensively to ensure their safety first. The necessary biosafety procedure for personal protective equipment was maintained properly. All kinds of logistics were provided to maintain standard procedures for sample collection. In case of any accidental hazard or damage during their work in the field, the principal investor was responsible for ensuring the proper treatment and management for both respondents and phlebotomists. In addition, as the respondents gave us their valuable 15 minutes during data collection, as compensation, a refreshment was arranged for all the respondents coming to TRCs with the help of the local authority.

Data analysis

In data analysis, we performed a frequency distribution table, different graphs, and sub-group descriptive analysis. The socio-demographic profile and co-morbidities of the respondents were analyzed through a frequency distribution table. The prevalence of HIV among tuberculosis patients was presented in a simple bar diagram. A sub-group analysis for the HIV-positive cases was also done by descriptive statistics. All the statistical analysis was performed by SPSS-25 version.

Results

Socio-demographic profile of the respondents

Among the 12,065 tuberculosis patients included in the study, the majority, 28.4% (n=3421), were 55 years and older with a mean age of 41.90 years (standard deviation=16.96), followed by <15 years 3.9% (n=469). The samples were collected from all eight administrative divisions of Bangladesh, with a maximum 25% (n=3020) TB patients from the Dhaka division, followed by 18% (n=2169) from Chattogram, 17.1% (n=2069) from Khulna, 10.0% (n=1206) from Rangpur, 9.6% (n=1159) from Sylhet, 7.1% (n=856) from Rajshahi, 7.0% (n=849) from Barisal and Mymensingh (6.1%) respectively. The majority, 75.85%, of the patients were urban residents, with 13.01% from Peri-urban and 11.14% from rural residences. More than half (56.0%) of the TB patients were male, and 43.8% were female, with a small portion (0.2%) being transgender. The majority, 82% (n=9898) of the patients were currently married, followed by 14.0% (n=1687) were unmarried, 3.4% (n=415) were widows or widowers, and 0.5% (n=65) were either separated or divorced. About 4327 (35.9%) of the TB patients were found to be illiterate, where 3081 (25.5%) had completed their primary education, 19.8% belonged to primary education, 1.5% had completed college or university, and 1.8% had completed post-graduation. The majority of the respondents were housewives (31.7%), followed by a farmer (18.4%), students (8.6%), Small business (8.3%), unemployed but able to work (6.8%) and day labourers (5.7%) respectively. The majority of the patients came from the nuclear family (70.9%), with 28.6% from joint family and a small portion (0.5%) were found out of the family (residing in hostels or mess etc.) (Table 1).

Table 1. Socio-demographic characteristics of the respondents.

Baseline characteristics	**Frequency (n)**	**Percentage (%)**
Age group (mean age=41.90; SD=16.96; Age range: 1 to 106 years)		
<15 years	469	3.9
15-24 years	1691	14
25-34 years	2101	17.4
35-44 years	2174	18
45-54 years	2209	18.3
55+ years	3421	28.4
Division		
Barisal	849	7.04
Chattogram	2169	17.98
Dhaka	3020	25.03
Khulna	2069	17.15
Mymensingh	737	6.11
Rajshahi	856	7.09
Rangpur	1206	10.00
Sylhet	1159	9.61
Residence		
Rural	1344	11.14
Peri urban	1570	13.01
Urban	9151	75.85
Sex		
Male	6762	56
Female	5284	43.8

Third gender	19	0.2
Marital status		
Unmarried	1687	13.98
Currently Married	9898	82.04
Separate/Divorce	65	0.54
Widow	415	3.44
Education		
Illiterate	4327	35.86
Less than Primary	2392	19.83
Primary completed	3081	25.54
Secondary Completed	1214	10.06
Higher Secondary Completed	655	5.43
College/University Completed	181	1.50
Post-Graduate Completed	214	1.77
Not agree to discuss	1	0.01
Occupation (categories having more than 5% of proportion)		
Housewife	3827	31.7
Farmer	2214	18.4
Students	1042	8.6
Small Business	998	8.3
Unemployed but Able to work	818	6.8
Day Labors	690	5.7
Type of family		
Nuclear Family	8551	70.9
Joint	3449	28.6
Out of Family	65	0.5

Patients' type and co-morbidities

Out of 12,065 respondents, 11778 (97.6%) of them were suffering from Tuberculosis (TB) and the rest 287 (2.4%) were found to be drag resistance tuberculosis (DRTB) patients. About 6788 (57.63%) of the patients had detected TB by Bacteriologically and the rest were clinically detected. More than eight out of ten patients were suffering from at least one co-morbidity where Diabetes (n=1119, 9.27%) was the more frequent followed by Hypertension (n=430, 3.56%), Asthma (n=386, 3.20%), COPD (n=244, 2.02%), Cancer (n=8, 0.07%), heart disease (n=201, 1.67%), CKD (n=48, 0.40%) and Thalassemia (n=7, 0.06%). COVID-19 was tested by 545 patients, and 4.22% (n=23) were prevalent (Table 2).

Table 2. Patient's type and existence of co-morbidity.

Characteristics	**Frequency**	**Percent**
Type of patients		
TB	11778.00	97.62
DR-TB	287.00	2.38
Type of patients' detection (n=11778)		
Clinically	4990.00	42.37
Bacteriologically	6788.00	57.63
Presence of co-morbidity		
One co-morbidity	1734.00	83.37

Two co-morbidities	281.00	13.51
Three or more co-morbidities	65.00	3.13
Diabetes		
No	10946.00	90.73
Yes	1119.00	9.27
Hypertension		
No	11635.00	96.44
Yes	430.00	3.56
Chronic Obstructive Pulmonary Disease (COPD)		
No	11821.00	97.98
Yes	244.00	2.02
Cancer		
No	12057.00	99.93
Yes	8.00	0.07
Asthma		
No	11679.00	96.80
Yes	386.00	3.20
Heart Disease		
No	11864.00	98.33
Yes	201.00	1.67
Chronic kidney disease (CKD)		
No	12017.00	99.60
Yes	48.00	0.40
Hepatitis		
No	12008.00	99.53
Yes	57.00	0.47
Thalassemia		
No	12058.00	99.94
Yes	7.00	0.06
Others co-morbidity		
No	11865.00	98.34
Yes	200.00	1.66
COVID-19 (n=545)		
Positive	23.00	4.22
Negative	522.00	95.78

Prevalence of HIV among Tuberculosis patients

A total of 12 HIV-positive cases were found among 12065 tuberculosis patients across the country. The positive cases were verified by diagnosing from another laboratory. Therefore, the HIV sero-prevalence among tuberculosis in Bangladesh is 0.1% (Figure 1).

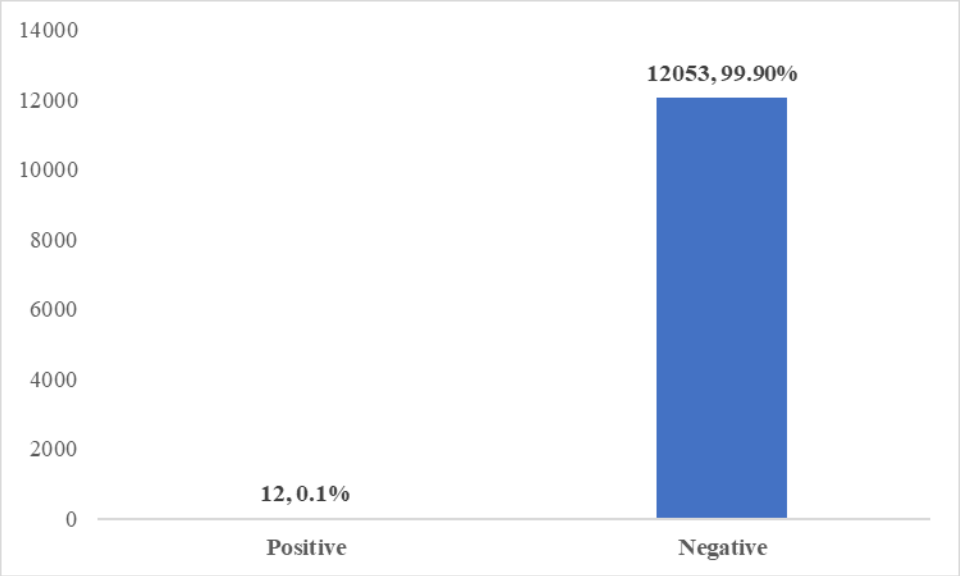

Figure 1. Prevalence of HIV among Tuberculosis patients

Socio-demographic profile of HIV-positive patients

Out of 12 HIV-positive cases, majority 33.3% (n=4) patients were from the age group 35-44 years, followed by 25.0%(n=3) from 45-54 years, 16.7% (n=2) from 25-34 years and above 55 years, and 8.3%(n=1) from the age group 15- 24 years. Most of the HIV-positive cases were male (n=7, 58.3%), and 5 (41.7%) were female patients. HIV prevalence was found to be higher among the lower educational group. The illiterate and less than primary group contributed 33% each (4 from each group respectively). Three HIV-positive patients had completed up-to primary education, and one patient had completed secondary education. Eight (66.7%) out of 12 patients were currently married, followed by two (16.7%) were unmarried, one patient (8.3%) was separated or divorced, and one (8.3%) was a widow. The HIV-positive patients' occupations were private service (n=1, 8.3%), small business (n=1, 8.3%), farmer (n=1, 8.3%), day labourers (n=2, 16.7%), transport labour (n=2, 16.7%), housewife (n=4, 33.3%) and others (n=1, 8.3%). Nine (75%) HIV-positive patients were from the nuclear family, and three (25%) were from joint families, where the majority (n=8, 66.6%) were from urban residents (Table 3).

Table 3. Socio-demographic characteristics of the HIV positive patients

	Frequency	**Percentage**
Age group		
15-24 years	1	8.3
25-34 years	2	16.7
35-44 years	4	33.3
45-54 years	3	25.0
Above 55 years	2	16.7
Gender		
Male	7	58.3
Female	5	41.7
Education		
Illiterate	4	33.3
Less than Primary	4	33.3
Primary completed	3	25.0

Secondary completed	1	8.3
Marital status		
Unmarried	2	16.7
Currently Married	8	66.7
Separate/Divorce	1	8.3
Widow	1	8.3
Occupation		
Private Service	1	8.3
Small Business	1	8.3
Farmer	1	8.3
Day Labors	2	16.7
Transport Labor	2	16.7
Housewife	4	33.3
Others	1	8.3
Family type		
Nuclear Family	9	75.0
Joint	3	25.0
Residence		
Peri Urb	2	16.67
Rural	2	16.67
Urban	8	66.66

HIV-positive patients' surgery history, contact with TB or DRTB history and their detection method

All the HIV-positive patients had co-infection with TB, and no one progressed to DR-TB. Three patients (25%) had a history of major or minor surgery, two (16.7%) had a history of close contact with TB or DRTB patient, ten (83.3%) had pulmonary involvement TB, seven bacteriologically (58.3%) detected, and nine (75.0%) were negative in both smear test and gene expert (Table 4).

Table 4. Distribution of the HIV-positive cases according to their surgery history and close contact with TB or DRTB history and different detection methods (n=12).

Variables	Frequency	Percent
Type of TB		
TB	12	100
DR-TB	0	0
History of major/minor surgery		
Yes	3	25.0
No	9	75.0
History of contact with TB or DRTB patient		
Yes	2	16.7
No	7	58.3
Do not Know	3	25.0
Pulmonary involvement		
Pulmonary	10	83.3
Extra pulmonary	2	16.7
Detection methods		
Clinically	5	41.7
Bacteriologically	7	58.3

Smear test		
Smear positive	3	25.0
Smear negative	9	75.0
Gene expert test		
Gene expert positive	3	25.0
Gene expert negative	9	75.0

Discussion

The prevalence of HIV among tuberculosis patients is unknown in Bangladesh. With the support of the National Tuberculosis Control Program (NTP), AIDS/STD Program (ASP), Directorate General of Health Services, Bangladesh, and the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka initiated the conduct of this study financially supported by Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM). For this, a nationally representative 12,065 tuberculosis patients were selected as a sample that provides important insights into the demographic and clinical characteristics of tuberculosis (TB) patients in Bangladesh, as well as the prevalence of HIV among TB patients.

The study found that a significant proportion of TB patients were aged 55 years and older, with a mean age of 41.90 years, which is consistent with other studies that have found TB to be more prevalent among older age groups [31,32]. However, a small proportion of TB patients were under the age of 15, which may indicate the need for targeted interventions to prevent and treat TB in children. It was also observed that TB patients were more prevalent in urban areas. Numerous studies have found TB to be more prevalent in urban areas due to factors such as overcrowding and poor living conditions [33-36]. Additionally, illiteracy was the frequent educational status among TB patients, which is consistent with other studies that have found low levels of education to be a risk factor for TB [37-39].

The study also found a high prevalence of co-morbidities among TB patients, with diabetes being the most common. This is evident in other studies that have found diabetes to be a major risk factor for TB [40-42]. Additionally, the study found a low prevalence of drug-resistant TB in Bangladesh. The Government of Bangladesh has taken numerous strategies to control TB [43]. The lower prevalence of drug-resistant TB may reflect the success of TB control programs in Bangladesh in preventing the spread of drug-resistant strains.

The study also provides important insights into the prevalence of HIV among TB patients in Bangladesh, with a seroprevalence of 0.1%. This is lower than the global average HIV prevalence among TB patients. According to the World Health Organization (WHO), globally, approximately 8% of TB patients are co-infected with HIV [32]. However, this co-infection rate varies widely by region and population group. In sub-Saharan Africa, both TB and HIV co-infection are highly prevalent and can vary from 50% to 75% [44,45]. Similarly, another study found that the prevalence of HIV among TB patients can vary from 3.8 to 72.3% [9]. In some regions with lower rates of both diseases, the co-infection rate may be much lower. For example, numerous studies conducted in Canada found that only 1.2 to 6.5% of TB patients were also infected with HIV [46,47]. The lower prevalence of HIV among TB patients was also found to be less than 1% in Pakistan [48,49], 1.5% in Somalia [50], 5.54 to 9% in India [51-53], 9.9% in Nepal [12] and less than 1% in China [10].

It was found that HIV prevalence was higher among the lower educational group, with illiterate and less than primary education groups contributing the most. The majority of the HIV-positive patients were male, and most of them were currently married. Housewives accounted for the most common occupation among the positive patients. Additionally, all HIV-positive patients were also TB patients, with most of them having pulmonary involvement TB. These findings are consistent with previous studies that have shown higher HIV prevalence among individuals with lower education and socio-economic status [12,40,54]. It is also well-established that men are at a higher risk of HIV infection compared to women, particularly in countries with high HIV prevalence [44,55].

The results suggest that HIV prevalence was nil among DR-TB patients, indicating a high prevalence of HIV/TB co-infection and difficulty in treating this form of the disease. Regarding the medical history of the patients, a small percentage had a history of surgery, and two patients had close contact with TB or DR-TB patients, which could be contributing factors to the development of TB. Additionally, the majority of HIV-positive patients had pulmonary TB, and bacteriological detection was found in over half of the patients. These findings are consistent with previous studies that have shown a high prevalence of HIV/TB co-infection, particularly in areas with a high burden of both diseases, such as sub-Saharan Africa [55]. Furthermore, previous research has shown that HIV-positive individuals are at an increased risk of developing TB, with a higher incidence of pulmonary TB and extrapulmonary TB compared to HIV-negative individuals [56]. The lack of DR-TB among HIV-positive TB patients is a positive outcome, as DR-TB can be more difficult and costly to treat than drug-susceptible TB. However, the findings emphasize the importance of integrated HIV/TB services and the need for targeted interventions to prevent and manage HIV/TB co-infection. It is important to note that the co-infection rate among TB patients is an important public health concern, as HIV-positive individuals are at higher risk of developing active TB disease. The study recommends that all TB patients be offered HIV testing, and HIV-positive TB patients should receive antiretroviral therapy in addition to TB treatment.

Conclusion

In conclusion, the prevalence of HIV is lower than one percent. The low prevalence of HIV among TB patients in Bangladesh underscores the importance of targeted interventions to prevent the progress of HIV infection to AIDS, acquiring new TB infection and promoting both the progression of latent TB infection to active disease and relapse of the disease in previously treated patients. Special attentions are needed among patients, particularly among older age groups, urban residents, and those with co-morbidities such as diabetes.

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Authors' contribution

Baizid Khoorshid Riaz- Involved in idea generation, fund acquisition, supervision and editing of the original draft to be submitted; Md. Kamrul Amin- Involved in project administration and supervision; Md. Shamiul Islam- Involved in fund acquisition and project administration; ANM Shamsul Islam, Jabin Akhter, Naznin Akter Jahan, Nasreen Farhana, Rafaat Choudhury, Mohammad Jamal Uddin, Ummul Khair Alam, Md. Nazmul Hassan Refat, Sadia Sobhan, Kamrun Nahar, Irfan Nowroze Noor, Md. Noor Ashad-Uz-Zaman and Fatima Nasreen- Involved in project administration and co-supervision; Mohammad Meshbahur Rahaman- Involved in data management, data analysis, interpretation, Writing and editing of the original draft to be submitted; Fahmida Khanam- Involved in supervision and project administration. All authors approved the original draft to be submitted.

Conflict interests

The authors declare that no conflict of interest exists.

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Ethical Clearance and permission of Data Collection

Ethical approval for the study was obtained from the Institutional Review Board of Bangladesh Medical Research Council (BMRC) with IRB registration number BMRC/NREC/2019-2022/993. Both verbal and written informed consent was obtained from all respondents prior to data collection. A brief introduction to the aims and objectives of the study was given first. Then, the written consent translated into the native language was read out to the illiterate tribal elderly. All collected data was kept anonymously. The design and delivery of data collection for this study continuously ensured enrolled populations' rights to privacy, confidentiality, informed consent, freedom of movement, and access to information were safeguarded, and any key populations were free from discrimination, involuntary treatment, isolation, and detention.

Data availability

The data of this study is publicly available by requesting the corresponding author.

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