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Epidemiology of tuberculosis patients at Mithamain Upazila, Kishoreganj district, Bangladesh

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Abstract
Bangladesh is a hotspot for TB infection. The COVID-19 pandemic has impacted many aspects of healthcare, including TB control programs. Our retrospective study was conducted with a total of 6873 sputum samples from a primary-level healthcare facility in Upazila Health Complex in Mithamain Upazila, Kishoreganj District, Bangladesh over a period from January 2020 to December 2022.The sputum sample was tested by acid-fast bacilli (AFB) staining. Among them, 3.08%, 2.53% and 2.03% patients were TB positive in the years 2020, 2021 and 2022, respectively. Positive results were higher in 25-44 years of men. No significant correlation with the incidence of TB cases in certain month was found appropriate. Farmers were found at the highest threat in in acquiring TB. By monitoring TB rates over time, public health officials can assess the impact of interventions and adjust strategies as needed to achieve the goal of ending the TB epidemic by 2030.

Keywords: Tuberculosis, AFB, Mithamain, occupation, gender, age

Introduction
Tuberculosis (TB) remains a significant global health concern, causing substantial morbidity and mortality. An estimated 10 million people have developed TB and almost 1.4 million have died from the disease worldwide in 2019. The burden of TB is higher in low- and middle-income countries, particularly in Asia and Africa, where over 95% of TB deaths occur [1, 2]. Bangladesh is among the countries with a high TB burden. In 2019, an estimated 364,000 people developed TB in the country, and approximately, 58,000 died from the disease. Bangladesh ranks among the countries with the highest incidence rates of TB, with around 221 cases per 100,000 population in 2019 [3].

The COVID-19 pandemic has had a significant impact on the global burden of tuberculosis (TB). A study published in The Lancet Global Health in 2020 analyzed the impact of the COVID-19 pandemic on TB incidence, prevalence, and mortality across 200 countries. The study estimated that the COVID-19 pandemic could result in an additional 6.3 million TB cases and an additional 1.4 million TB deaths globally between 2020 and 2025. The study highlighted the importance of mitigating the impact of the pandemic on TB control efforts to prevent these additional cases and deaths [4, 5]. Another study published in the European Respiratory Journal in 2021 examined the effect of the COVID-19 pandemic on TB case notifications in 2020 across 200 countries. The study found that the number of TB case notifications decreased by 25-30% on average in 3 high burden countries as India, Indonesia, the Philippines between January and June in 2020 compared to the same 6-month period in 2019. These reductions in case notifications suggest that many TB cases went undiagnosed and untreated during the pandemic [1, 6].

It is important to note that the specific impact of the COVID-19 pandemic on TB burden can vary across countries and regions, depending on their healthcare systems, existing TB control measures, and the severity of the pandemic's impact. Efforts to mitigate the impact of COVID-19 on TB control include maintaining essential TB services, ensuring uninterrupted access to diagnosis and treatment, strengthening infection prevention and control measures, and integrating TB and COVID-19 response activities. Moreover, surveillance systems facilitate the early detection of TB cases, enabling prompt diagnosis and treatment initiation. Timely identification of cases reduces the risk of transmission and prevents the development of severe forms of the disease [7, 8].

By analyzing trends over time, public health authorities can assess the effectiveness of prevention strategies, identify gaps, and make informed decisions to improve TB control efforts [9]. Therefore, this study was aimed at TB detection of mycobacterial infection in putative patients of Mithamain Upazila, Kishoregonj District in Bangladesh.

Materials and Methods

Study time and study location

This is a retrospective study and the data was collected at a primary level health care facility in Upazila Health Complex at Mithamain Upazila, Kishoreganj District in Bangladesh over a period from January 2020 to December 2022. The geographical location of Mithamain Upazila is presented in Figure 1. The National Tuberculosis Control Program (NTP) under the government (govt.) field staff like CHCP (Community Health Care Provider), HA (Health Assistant), HI (Health Inspector) and the supportive organization as a non-governmental organization (NGO) work together at the field level. They combine sputum collection at the periphery level of this Upazila. Supportive organizations like Damien foundation and its field staff with govt. field staff collect presumptive patients' sputum samples from houses or their surrounding locations. They ensure community mobilization activities including door-to-door syndromic surveillance to find tuberculosis patients, along with raising awareness about its symptoms within the community.

Sample collection

Every suspected person will be given two sputum containers for collecting two separate samples of 1 mL sputum, one in the early morning and the other being collected on the spot. Then, the presumptive samples were transferred to the Upazila Tuberculosis laboratory with ice pack or maintaining cold chain. All the samples received a Lab ID and then, went to the AFB staining procedure. A total of 6873 sputum samples were collected in two phases. All the suspected patients, including the pediatric patients, were included in the present study. Basic information like gender, age and socio-demographic information were collected.

AFB staining

AFB staining is widely considered to be a gold standard in the diagnosis of tuberculosis. At first, the sputum sample was either smeared on a microscopy slide immediately or preserved in a refrigerator at 2°- 8°C overnight and then, prepared the next day. The staining procedure was followed by the previously mentioned methodology with slight modification [10]. In brief, the slides were fixed by heating and stained with 0.1% auramine solution for 15 minutes, acid alcohol for 3-5 minutes and methylene blue for 30 seconds with distilled water washing done in between. The slides were then dried in the air before microscopy, which was done in a standard light fluorescent microscope under 20X-40X magnification. After detection of acid fast bacilli, grading was done according to the fluorescence microscopy (FM) scale. In this scale, negative means zero bacilli in each length, scanty means 1-44 bacilli in each length, + means 45-449 bacilli in each length, ++ means 15-149 bacilli and +++ means more than 150 bacilli per high power field.

Data Analysis

Collected data were entered in the MS Excel spreadsheet, cleaned and coded appropriately. The analysis was carried out using Statistical package for social sciences (SPSS). Data analysis was performed using Student's t test where applicable. All P-values < 0.05 were considered significant.

Ethical Issues

Necessary permissions were obtained from the concerned authorities before the initiation of data collection. Permission to conduct study was obtained from the Medical Officer in charge of the Upazila Health Complex. As it was a secondary data analysis, the ethical clearance was waived off by the department.

Results

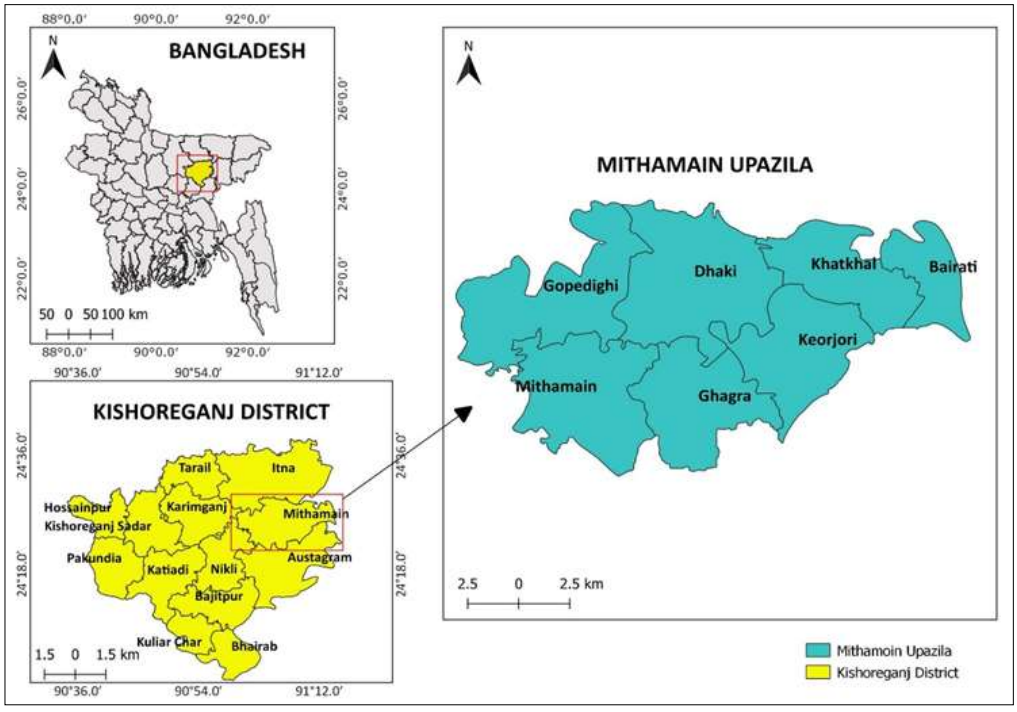

Fig 1: Geographic location of the Mithamain Upazila in Kishoreganj District in Bangladesh.

A total of 6873 suspected cases were tested for TB. Among them, only 168 showed positive results. The data obtained from TB positive patients was then classified according to their age, gender and occupation.

There were a total of 1625, 2288 and 2960 suspects, with almost 1575 (96.92%), 2230 (97.47%) and 2902 (98.04%) patients being negative in the years 2020, 2021 and 2022, respectively. Only as low as 3.08%, 2.53% and 2.03% were tested as total positive and among them 10%, 13.80% and 6.70% were relapse cases in 2020, 2021 and 2022, respectively, which indicates that tuberculosis detection was much lower at this diagnostic center.

There is always a relationship between disease and age. The age range taken for the TB positive patients was 0 to >65 years with a mean age of 40.76 years, 41.26 years and43.35 years in 2020, 2021 and 2022, respectively. The highest percentage of patients were in the age group of 35–44 years, comprising 28%, 25.86% and 26.67% in the years 2020, 2021 and 2022, respectively. Mostly, the positive cases increase over the age of 35-44 years. Subsequently, the number of positive cases went down considerably until the age group reached >65. The number of TB positive cases again increased at the former age category. In any year, no positive cases under 0-4 years age group was observed (Table 1 and Figure 2).

According to our study, the highest proportion of TB patients were farmers, comprising 40% (20), 34.48% (20) and 46.67% (28) in 2020, 2021 and 2022, respectively. The second highest occupation was housewife consisting of 18%, 25.86% and 23.33% in the years 2020, 2021 and 2022, respectively. Others in occupation include unemployed, labour, student, garment worker, businessman and others.

Sometimes, the distinction between genders is prominent in certain diseases. A significantly higher percentage of TB positive patients were males as compared to females ($P < 0.05$) in any year. The male patients were 70%, 65.52%, and 71.67% in the years 2020, 2021 and 2022, respectively. However, no significant relation concerning month-wise frequencies of TB cases between male and female from 2020 to 2022 was observed (Table 1 and Figure 3).

Monthly tuberculosis detection was observed here, with the highest number (60) of positive cases occurring in the year 2022. The count was comparatively higher in the rainy monsoon season, which counts from June to October in any of the year relating to the pre monsoon hot (March to May) or cold winter seasons (November to February). No positive cases were observed in the months of April and May in 2020, and July in 2020. However, there is no month-wise distinct coherence observed over the years. COVID-19 might have an influence on month-wise discrepancies in patient numbers from 2020 to 2022 (Figure 4).

Table 1: Epidemiological profile of TB patients (168) in three successive years.

Variables	Frequency			Percentage (%)		
	2020	2021	2022	2020	2021	2022
Sputum Results						
New	45	50	56	90	86.20	93.30
Relapse	5	8	4	10	13.80	6.70
Total Positive	50	58	60	3.08	2.53	2.03
Total Negative	1575	2230	2902	96.92	97.47	98.04
Total	1625	2288	2960	100	100	100
Age (in years)						
0-4	0	0	0	0	0	0
5-14	1	1	0	2	1.72	0
15-24	7	6	9	14	10.34	15
25-34	9	14	11	18	24.14	18.33
35-44	14	15	16	28	25.86	26.67
45-54	7	6	6	14	10.34	10
55-64	4	5	7	8	8.62	11.67
>65	9	11	11	18	18.97	18.33
Total	50	58	60	100	100	100
Sex						
Male	35	38	43	70	65.52	71.67
Female	15	20	17	30	34.48	28.33
Total	50	58	60	100	100	100
Occupation						
Housewife	9	15	14	18	25.86	23.33
Unemployed	3	3	5	6	5.17	8.33
Labour	6	11	3	12	18.97	5
Student	3	2	2	6	3.45	3.33
Garment worker	7	4	4	14	6.90	6.67
Farmer	20	20	28	40	34.48	46.67
Businessman	1	2	3	2	3.45	5
Others	1	1	1	2	1.72	1.67
Total	50	58	60	100	100	100

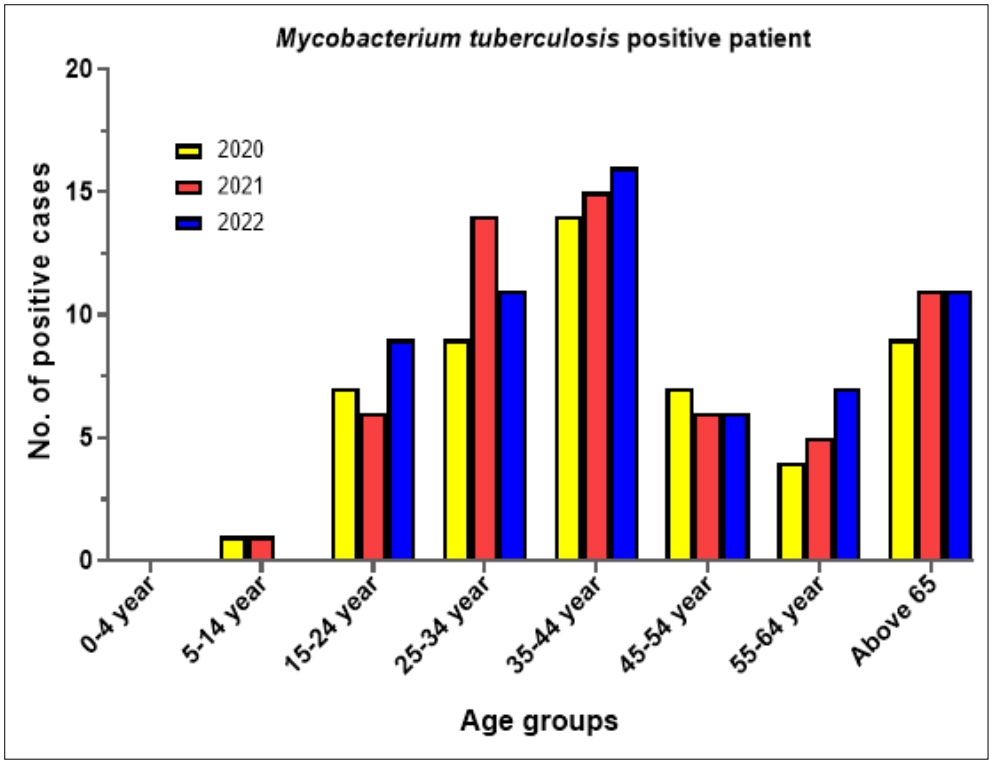

Fig 2: Distribution of TB positive patients according to age category in the three successive years.

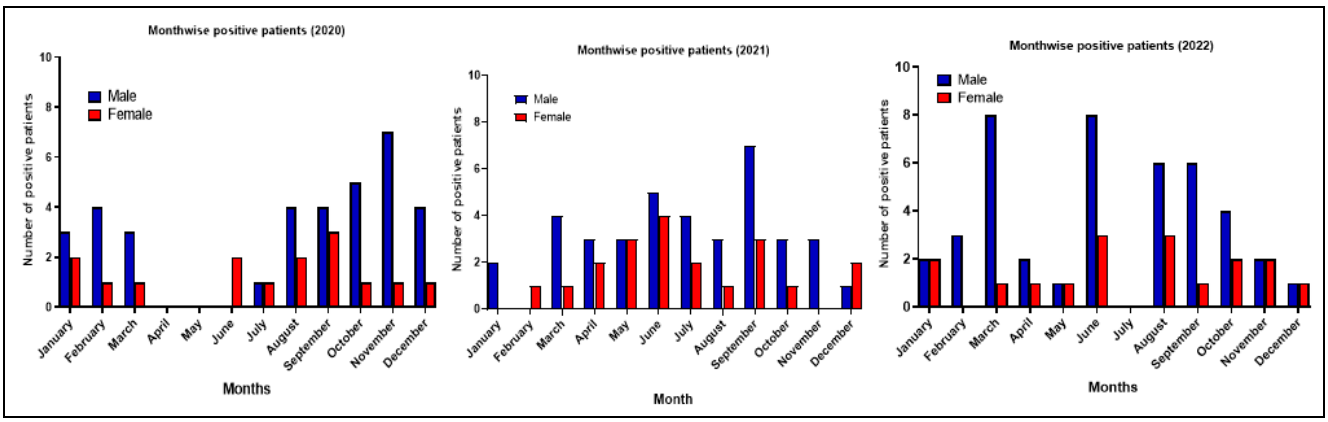

Fig 3: Gender-wise distribution of TB positive patients in the indicated months and years.

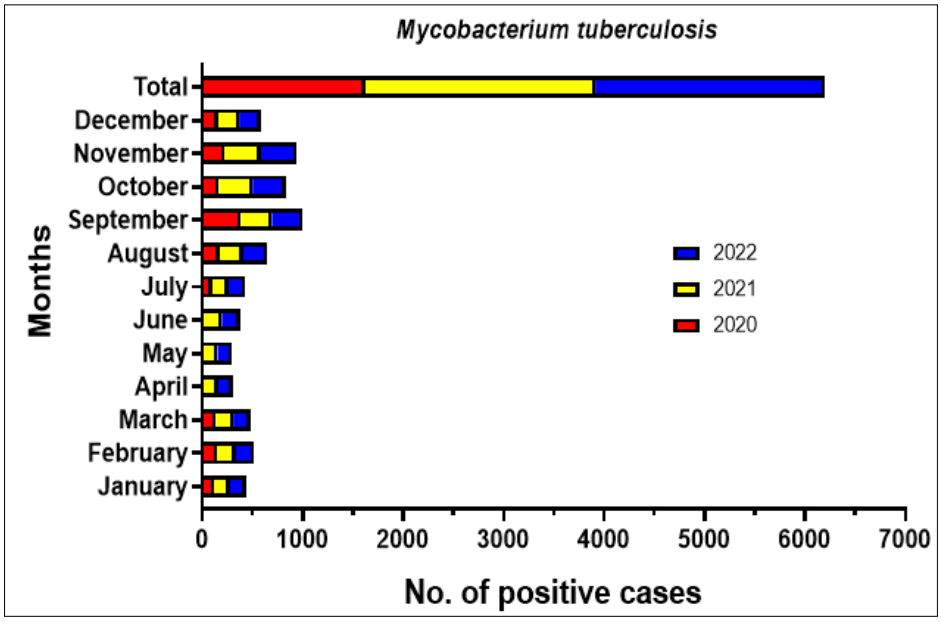

Fig 4: Month-wise frequency of TB positive patients in the three consecutive years.

Discussion

In Bangladesh, the highest number of tuberculosis (TB) cases can vary from year to year and may not be consistently associated with a specific month. The occurrence of TB cases depends on various factors such as population density, healthcare access, socio-economic conditions, and prevalence of risk factors [11]. Tuberculosis (TB) cases can occur in individuals across different age groups in both males and females. However, certain age groups may have a higher burden of TB compared to others. In our present study, male individuals with TB cases accounted for 70%, 65.52% and 71.67% in the years 2020, 2021 and 2021, respectively. According to the latest available data from the World Health Organization (WHO) Global Tuberculosis Report 2022, the highest burden is in adult men, who accounted for 56.5% of all TB cases, adult women accounted for 32.5% and children for 11% of cases in 2021. Globally, the TB burden is slightly higher among males compared to females. The causes behind the scenario can be various factors such as biological, social, and cultural differences. Men are more likely to engage in behaviors that increase their risk of TB infection, such as smoking, alcohol consumption, and exposure to occupational hazards. Additionally, men may delay seeking medical care, which can lead to more severe TB infections and increased transmission rates [12, 13].

Our data did not find any TB cases in the age group 0-4. Even with the 5-14 age group, only 2 TB cases were detected from the year 2020 to 2022. This might be due to the effect of the BCG vaccine that is widely used and that can prevent severe forms of TB in children [14, 15]. The highest caseload was observed in the age group, 25-44 years, which is considered as the most active and functioning age. TB cases are the highest in adults because TB is primarily an airborne disease that spreads through the air when an infected person coughs, sneezes, or talks. Adults are more likely to be exposed to TB bacteria in their daily lives, such as in crowded living conditions, workplaces, or public transportation. This age group is often the most economically active and socially engaged, which increases their risk of exposure to TB [16]. Another potential cause could be the effectiveness of the BCG vaccine that is of no use in adults [14].Additionally, a decline in TB cases was observed after 44 years of age and then, again increased at >65 in any of the studied years. Older adults may have decreased immunity and underlying health conditions that increase their risk of developing TB [16, 17].

In our present study, we found that the most affected occupation was farmers followed by housewife in any of the studied years. The major occupation in Mithamain Upazila is agriculture, with a focus on rice cultivation [18]. Therefore, farmers might be the most frequently affected occupation. According to a study conducted by the National Tuberculosis Control Program (NTP) in Bangladesh, the occupations that are mostly affected by TB in Bangladesh are those that involve close contact with the public, such as healthcare workers, teachers, and transport workers. The study found that healthcare workers had the highest incidence of TB, followed by teachers and transport workers. This is likely due to the increased risk of exposure to TB bacteria in these occupations, as well as the potential for delayed diagnosis and treatment due to stigma and discrimination associated with TB [19]. However, TB disproportionately affects populations in various occupations in different areas.

The COVID-19 pandemic has had a significant impact on TB cases worldwide. According to the World Health Organization (WHO), the COVID-19 pandemic has disrupted TB services, leading to a reduction in TB case detection and treatment. This is due to various factors, such as the diversion of resources and healthcare workers to COVID-19 response efforts, reduced access to healthcare services, and fear of contracting COVID-19 in healthcare facilities [20]. The same scenario was seen in Bangladesh as well [21]. It is important to do surveillance for TB cases after the COVID-19 pandemic because the pandemic has disrupted TB control efforts worldwide. Surveillance for TB cases after the COVID-19 pandemic can help identify individuals who may have been missed during the pandemic and ensure that they receive timely diagnosis and treatment. This can help prevent the spread of TB and reduce the burden of the disease.

Conclusion

The COVID-19 pandemic has had a significant impact on TB diagnosis, treatment, and control efforts. The pandemic has disrupted TB services, leading to a decrease in TB case detection and treatment initiation. This has resulted in an increase in undiagnosed and untreated TB cases, which can lead to more severe disease and increased transmission rates. However, TB surveillance studies during the COVID-19 pandemic show that they may not accurately reflect the true burden of TB due to disruptions in TB services and decreased access to healthcare. Therefore, surveillance is important to combat the extra burden of TB because it helps to keep track of the spread of the disease and identify potential outbreaks before they become widespread. By monitoring TB cases and identifying patterns and trends, surveillance can provide valuable insights into the effectiveness of TB control measures. Surveillance also helps health officials to allocate resources and target interventions to areas where they are needed most, which can help to reduce the overall burden of the disease. Additionally, surveillance can be used to identify high-risk groups and implement targeted prevention and control strategies to reduce the risk of transmission and improve patient outcomes.

Conflict of Interest

Not available

Financial Support

Not available

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