

# Tuberculosis Burden in Bangladesh: Progressions and Challenges of Continuing Control Intervention

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## Abstract

Tuberculosis (TB) has been a significant public health burden in Bangladesh, and to address this issue, the country has implemented the Directly Observed Treatment Short-Course (DOTS) intervention since 1993. The government has partnered with non-governmental organizations (NGOs) to implement community-based TB control programs. Research has shown that this approach has led to significant success in TB control, including a high case detection rate (> 81%), successful TB treatment (95%), and reduced TB mortality (27/100,000 population) over the past two decades. However, there are still significant concerns regarding the control of people living with HIV-TB (PLHIV-TB), multidrug-resistant TB (MDR-TB), and latent TB infection (LTBI). Additionally, the COVID-19 pandemic has slowed down the progress of TB control efforts. Challenges such as inadequate linkages with local NGOs, social stigma, gender discrimination in TB diagnosis, inadequate human resources, and poverty factors further exacerbate the situation. This study calls for a paradigm shift in TB control intervention towards a rights-based and need-based approach, considering gender, ethnicity, elderly people, and children. By addressing these challenges and implementing a comprehensive approach to TB control, Bangladesh is expected to achieve its goal of ending TB by 2035.

**Keywords:** Bangladesh, DOTS, Community-based, NTP, Public Health, Tuberculosis (TB).

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## 1. INTRODUCTION

Tuberculosis is one of the most ancient diseases in human history, co-existing with humans for thousands of years. Examination of Egyptian mummies' skeletons revealed symptoms of TB dating back to 2400 BC. In 460 BC, Hippocrates recognized the symptoms of a wasting disease affecting the lungs, cough, and fever, naming it "Phthisis" [1, 2]. In Europe, the sickness due to TB was known as "king's evil," and it was believed that the affected person could heal after an imperial touch [3]. In 1839, German Physician J. L. Schönlein proposed the term "tuberculosis" to be used as the generic name for all expressions of phthisis since the tubercle was the anatomical basis of the disease [4]. After centuries of continuous effort, Dr. Robert Koch discovered the cause of the disease, tubercle bacillus, in 1882, which was considered a milestone in the history of medical science. Later, in 1886, Bacterium tubercle

bacillus was termed *Mycobacterium tuberculosis* [5,6]. Despite these discoveries, tuberculosis (TB) remains a major global public health concern and one of the leading causes of death in the world in the 20th century.

TB is a contagious infection that usually attacks the lungs but can also affect other parts of the body, such as the brain, kidneys, or spine. There are two types of TB: Latent TB and Active TB. People with latent TB infection do not feel sick and do not have any symptoms, but they carry the germs in their bodies and cannot spread TB infection to others. Active TB has a greater burden than latent TB and acts as an infection source for contacts. A latent or active TB infection can also be drug-resistant, which is the most urgent and difficult challenge facing global TB control. Patients with TB who are resistant to at least isoniazid and rifampin are called Multi-Drug Resistant-TB (MDR-

TB) [7]. WHO recognised that Multidrug-resistant TB (MDR-TB) remains a public health crisis and a health security threat for the world. In 2021 globally, an estimated 10.6 million people including 1.2 million children fell sick with TB and about 1.6 million people died due to TB (including TB with HIV). Tuberculosis is considered the 13th leading cause of death and the 2nd largest infectious disease after COVID-19 (above HIV/AIDS). Besides, COVID-19 pandemic has been significantly influencing the enhanced TB mortality since 2020 [8, 9].

TB has become common in all nations and age categories. According to the data, most deaths and infections occurred in developing nations. The World Health Organization (WHO) proclaimed tuberculosis a worldwide public health emergency in 1993. In Bangladesh, tuberculosis is currently regarded as the leading public health concern. Bangladesh ranks seventh among the 30 countries with the greatest prevalence of tuberculosis; Bangladesh ranks fourteenth among countries with a high prevalence of multidrug-resistant tuberculosis (MDR-TB). However, tuberculosis is curable and preventable. Approximately 85% of TB patients can be successfully treated with a six-month course of medication. The United Nations (UN) Sustainable Development Goal (SDG) 3: Good health and well-being targets the ending of TB by 2030 [10].

## 2. OBJECTIVES AND METHODOLOGY

Tuberculosis has been a significant public health challenge in Bangladesh for decades. Once considered a curse in rural areas of Bangladesh, hundreds of thousands of people died without treatment. The government introduced an official tuberculosis control program on a limited scale in 1965 during the Pakistani regime. After independence, the Government of Bangladesh expanded TB services at the Upazila level and introduced the DOTS (Directly Observed Treatment, Short-course) Model as the primary intervention strategy in the early 1990s [11]. The study focuses on the ongoing DOTS strategy's implementation mechanisms through top-down and bottom-up (community-based) approaches and analyses the intervention's impact on gender and poverty. The study emphasizes the importance of the GO-NGO partnership in community engagement for the success of TB control programs. The research identifies the success of the TB control intervention and investigates the primary obstacles to reducing the burden of disease in Bangladesh. In this study, the burden of ill health due to tuberculosis refers to the entire, collective effects of TB in the country. These consequences include health,

social aspects, and costs to society. These consequences include health, social aspects, and costs to society. Moreover burden of ill health due to TB explores the inclusive image of mortality and disability in the country, time, age, and sex which computes health loss from TB and threat issues, so that health-wellbeing structure can be improved and inequalities eliminated [12]. The current study is predicated on a qualitative review of scholarly journal articles, government documents, and international credentials. In addition, the study collects data and information from reputable websites such as UN, WHO, Directorate General of Health Services (DGHS), Bangladesh, National Tuberculosis Programme (NTP) etc.

## 3. Present Status of Tuberculosis in Bangladesh

Tuberculosis is a massive health hazard for Bangladesh for a long time. According to the WHO, Bangladesh is one of the 7th top most TB-burdened countries in the world [10] (WHO 2021). Besides, Bangladesh is one of the most densely occupied countries in the world where 169.36 million people live in only 147570 sq km and till now where 24.3% of people live under the poverty line with poor living and working conditions. About 47% of urban populations live in slum and around 75 percent of slum households live in one room [13]. For people living in slum areas, life is tricky and often dangerous with higher male nutrition, poor health services, serious water and air pollution and fragile environment are more vulnerable to TB infection. Further, people who use drugs are more likely to get tuberculosis because of socioeconomic factors like poor housing, homelessness, incarceration, poverty, tobacco use, and alcohol abuse [14]. Besides, a huge number of people are not conscious about healthy life and healthy lifestyle in city areas. All of these factors, especially unhealthy living and unhealthy lifestyles accelerated TB [15] and enhance to sustain TB infection in Bangladesh.

According to WHO, the occurrence and commonness of all types of Tuberculosis in 2020 were 360,000 in Bangladesh and TB rate was estimated 218 per 100,000 population. An expected 44000 for each 100,000 individuals expired because of Tuberculosis during the year 2020. Further, HIV with TB also is a growing concern for Bangladesh. The incidence and mortality rates of tuberculosis and HIV are positively correlated. Despite the fact that HIV is the most significant risk factor for Mycobacterium tuberculosis (MTB) infection progressing to TB disease. Data showed HIV-positive TB prevalence in Bangladesh was 710 and mortality was 170 during 2020 (Table-1).

**Table 1: Estimates of TB burden in Bangladesh [8]**

Criteria	TB burden in 2021 (population)	Tuberculosis incidence per 100,000 population (TB rate)
Total TB occurrence	375,000	221
HIV-positive TB occurrence	730	0.43
HIV-negative TB mortality	42,000	25
HIV-positive TB mortality	170	0.1

Moreover, TB burdens in children an important public health issue in Bangladesh. The estimated TB burden in children less than 14 years were around 29000 in 2020. Therefore, the mentioned information unveiled the severity of TB occurrence in Bangladesh.

#### 4. Approach to Health Promotion Intervention to Control TB

In 1985, Karel Styblo, a renowned Dutch physician, proposed the DOTS strategy to control the global tuberculosis burden. The 'DOTS model' was the outcome of an international collaboration aimed at expanding national tuberculosis (TB) programmes in partner nations. After a lengthy trial in Tanzania, the World Health Organization (WHO) adopted this model with the Global Tuberculosis Programme (GTB) in 1990 as its primary global strategy [16, 17]. During 1993-1995, the WHO rapidly expanded the DOTS approach, which was the first comprehensive method to combat tuberculosis and intended to have a significant impact on the TB epidemic. The DOTS strategy consisted of five fundamental elements, which bolstered the capacity of national initiatives to analyze and treat TB cases, with a focus on those who could transmit the disease [18-20].

The TB control program was officially initiated in Bangladesh in 1965 with the establishment of the National Tuberculosis Program (NTP). Further, in the 1990s, the Directorate General of Health Services (DGHS), Bangladesh, strengthened the National Tuberculosis Program (NTP) as a major government scheme to decrease morbidity, mortality and transmission of TB in Bangladesh. The NTP adopted the DOTS strategy as a "top-down approach" during 1992-98 under the mega project of "Further Development of TB and Leprosy Control Services" with the support of international actors. The NTP initiated the field execution of DOTS in November 1993 in four Upazilas and increased it to cover the whole country by mid-1998 [21]. By 2003, the DOTS program covered the maximum population of the country. The government of Bangladesh linked this program with the Millennium Development Goals (MDGs) and later in Sustainable Development Goals (SDGs) under health-related targets to reduce its epidemics. The plan included the treatment of all MDR-TB cases and aligned all private and public health providers. Further, the NTP incorporated collaborative TB with HIV activities into national strategic plans for the year 2006 to 2011 and 2012 to 2016 [11]. The

government of Bangladesh has been providing TB diagnosis and treatment totally free of cost all over Bangladesh with the support of developing partners. The National Tuberculosis Control Program, Bangladesh, revised and updated its target to "end the TB epidemic aiming to achieve a target of 10 new cases/100,000/year in 2035; (Projected 2015 baseline of 225 cases/100,000) towards a TB Free Bangladesh: Zero deaths, disease and suffering due to TB" [22]. The approach to TB control through the DOTS strategy in Bangladesh is mentioned in Figure-1.

However, the DOTS protocol, a combination of technological and administrative measures, rapidly makes the compelling cases non-irresistible and breaks the pattern of transmission. The technique has been fruitful in large and small countries, both wealthy and poor. Countries with high cure and inclusion rates include Benin, Guinea, Peru, Nicaragua, China and Viet Nam. In China, secure rates increased from under 50% to over 95% in territories secured by DOTS, and about 50% of people in China were secured by the technique today. In Peru, government commitment to the procedure had brought about almost 100% DOTS coverage in the country, and recovery rates were up to 83%. DOTS, one of the most widely used and longest-running interventions in global health, is necessary for significant improvements to efforts to control tuberculosis, including the new Stop TB Strategy [16, 24, 25]. Under the DOTS programme, the Bangladesh government launched three major health initiatives: TB treatment, prevention of transmission, and Vaccination of children with the Bacille Calmette-Guérin (BCG) vaccine for TB control [11].

However, Bangladesh simultaneously initiated community-based activities as a bottom-up approach through non-governmental organizations (NGOs) to enhance TB control. Development professionals and intellectuals have exploited the term "community participation" (also known as "community involvement" and "community-based") since the 1970s. In the context of a development model, these terms are popularly known as "alternative development" [26]. International research suggests that complementary approaches like community contribution are vital to implementing the DOTS strategy [27]. Meaningful community engagement is a crucial factor in accelerating the implementation of the DOTS policy in Bangladesh. Therefore, WHO focused on integrated community-based TB activities within existing health and development programs. Thus, to achieve the DOTS

strategy, Bangladesh considered a series of bottom-up approaches under 'community-based TB control initiatives' to empower local people to combat TB in an integrated way. Leading NGOs, such as Bangladesh Rural Advancement Committee (BRAC), Association for Social Advancement (ASA), Health, Education and Economic Development (HEED) Bangladesh, Damien Foundation, International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B), Rangpur Dinajpur Rural Service (RDRS), Smiling Sunshine Clinic, Urban Health Care Program, and some local NGOs, have

intensively participated in the community-based TB control program with NTP. Presently, Bangladesh highly emphasizes local ownership and the sustainability of the TB intervention program as a national priority. Some community initiatives include public-private partnership at the grassroots level, local advocacy for TB-affected people, communication and social mobilization at the grassroots level, livelihood improvement for rural and slum areas, community participation for women, and health awareness-raising programs in urban areas [22].

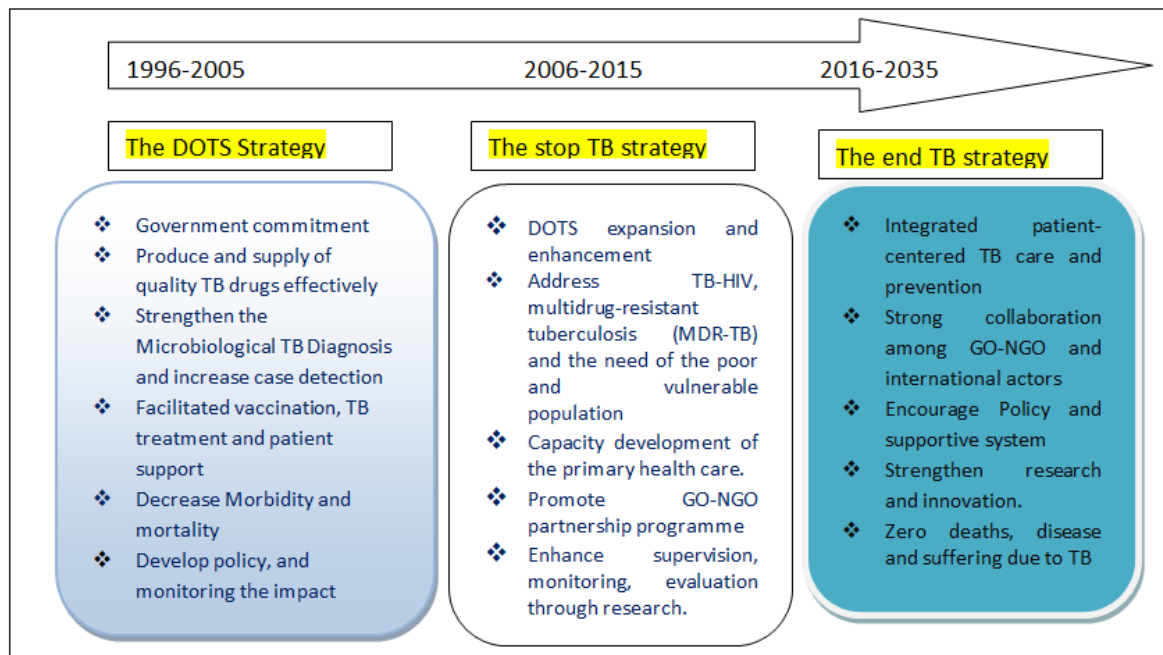


Figure 1: Tuberculosis (TB) control through DOTS strategy in Bangladesh [11, 22, 23]

In Bangladesh, the innovation for community participation to provide certain TB services was mostly acquired by the Bangladesh Rural Advancement Committee (BRAC). BRAC implemented the WHO-recommended 'community-based TB care,' which had several successful experiences in selected areas [28, 29]. 'Advocacy, Communication, and Social Mobilization' (ACSM) were the three key pillars implemented by BRAC to control TB in rural Bangladesh. The community-based social mobilization efforts increased awareness about the availability of DOTS for TB and expanded knowledge about TB diagnosis, treatment, and prevention. Moreover, by utilizing local leaders and resources, most of the NGOs, especially BRAC, achieved better results in TB control. The community-based TB care approach stimulates the common people through local innovation and the equitable use of local tools. The primary challenge of the strategies was to increase the maximum case detection (from 61% to 100%), especially among women, the older population, children, and minorities, where it was assumed that the most 'missing cases' are to be found [11, 22, 30, 31].

#### 4.1. Gender, Poverty and TB control Intervention

Gender and poverty-related barriers play a significant role in hindering the prevention, diagnosis, treatment, and care of tuberculosis in Bangladesh. The response to Tuberculosis (TB) must shift towards an individual and network-centric, gender-sensitive, and rights-based approach. In order to eradicate TB, it is important to understand the human rights and gender-related barriers that prevent individuals from accessing TB services, including the stigma and discrimination associated with the disease. TB disproportionately affects financially disadvantaged networks, such as women and the elderly, and women in Bangladesh are particularly vulnerable due to their lower socioeconomic status. Structural and communal barriers also impede access to appropriate TB prevention, diagnosis, treatment, and care [32, 33].

Studies have shown that women are often in a disadvantaged position in TB treatment due to high levels of stigma, fear, and casualness in care-seeking, which are highly relevant to gender discrimination. Despite the accessibility of TB services free of charge throughout the country, socio-cultural reasons often

prevent women from seeking care. Research has found that the government TB control programme during the 1990s was not women-friendly in terms of service provision, lacked provisions for disabled persons, did not address hard-to-reach regions, marginalized and remote populations, or provide for third-gender or transgender individuals. Social counselling was also absent, and there was a lack of coordination at the field level [34, 35].

Gender discrimination in TB case identification has profound implications for public health, particularly as women have lower access to health services, hindrance in diagnosis and treatment, and increased indirect disease burden [36, 37]. Social stigma due to institutional norms, societal customs, traditional beliefs, and intra and interpersonal attitudes towards TB is a major barrier to TB control. Fear of social effects can prevent individuals from seeking and completing medical treatment, leading to worse health outcomes. Women are often the victims of social stigma, which is frequently used as a means of gender discrimination in TB treatment [38, 39]. Research has shown that women experience more social stigma than men, have lower admission opportunities at medical services for TB operations, and experience longer delays in diagnosis, particularly elderly females. Women often have to wait longer for treatment, and women's access to treatment is significantly lower than that of men. In the case of treatment and diagnosis, men needed to wait for 8 weeks whereas women experienced more weeks than men [34, 40-42]. Chowdhury *et al.*, (2015) noticed that mean degrees of social stigma were much higher in women (55%) [43] and women's access to treatment was significantly lower than male (1:1.8) [44].

Poverty is also an important risk factor for TB incidence, as poverty-prone people often live in poor housing and adverse environments, have limited access to food and nutrition, and have less opportunity to access quality health services [45, 46]. They are also often less educated. All these social determinants combine to increase the risk of TB among the poor. In Bangladesh, 20.5% of the population lives under the upper poverty line [47], putting them at greater risk for TB incidence. In India, poverty has a strong association with prevalent TB. Therefore, poverty is also a significant barrier to the decline of TB in Bangladesh. International research showed the occurrence of TB was significantly higher in the poorest level in India and had a strong association between poverty and prevalent TB [48].

## 5. Success of the Intervention and Challenges to Reduce the Burden of TB Ill-health

Since 1994, the government of Bangladesh (GoB) has been working towards expanding Directly Observed Treatment, Short-Course (DOTS) services to cover the entire population, with the aim of improving tuberculosis (TB) control. Later on government incorporated a community-based TB control approach to enhance the effectiveness of the programme. Research has shown that community-based management of multidrug-resistant TB (MDR-TB) in Bangladesh has yielded significantly better outcomes than hospital-based management. The TB control programme in Bangladesh has achieved notable success in terms of case detection, free diagnostic and treatment facilities, an integrated approach between government and non-governmental organizations, capacity building, and updated guidelines [22, 49].

Currently, DOTS coverage has expanded to almost the entire population of Bangladesh, achieving 100% coverage. The interventions have resulted in improved case notification rates (CNR), with the new smear-positive TB rate increasing from 46/100,000 in 2004 to 97/100,000 population in 2019. All form TB case notifications have also increased, reaching 174/100,000 population in 2019 from 72/100,000 population in 2004. Figure-2 shows the significant increase in TB case notification over the last two decades due to the GO-NGO integrated approach [22]. However, the notification work was slightly interrupted in 2020 due to the COVID-19 pandemic, but it resumed in 2021 [50].

According to the World Health Organization (WHO), the TB incidence rate of all forms (new and relapse) in Bangladesh was 221/100,000 population in 2021. The case detection rate (CDR-all forms) has increased from 26% in 2001 to 45% in 2010, and by the end of 2019, it had increased by 81% [8]. The success of the intervention surpassed the target of 85% and reached 94% in 2017 [51]. The WHO has also reported that the TB treatment success rate in Bangladesh for new and relapse cases registered in 2019 was 95%, with a cohort size of 289,863. Furthermore, the TB case fatality ratio reduced to 13%, and the number of deaths due to TB declined significantly from 69 (per 100,000) in 2003 to 34 cases in 2017. By the end of 2020, it had further decreased to 27/100,000, as shown in Figure-3 [10].

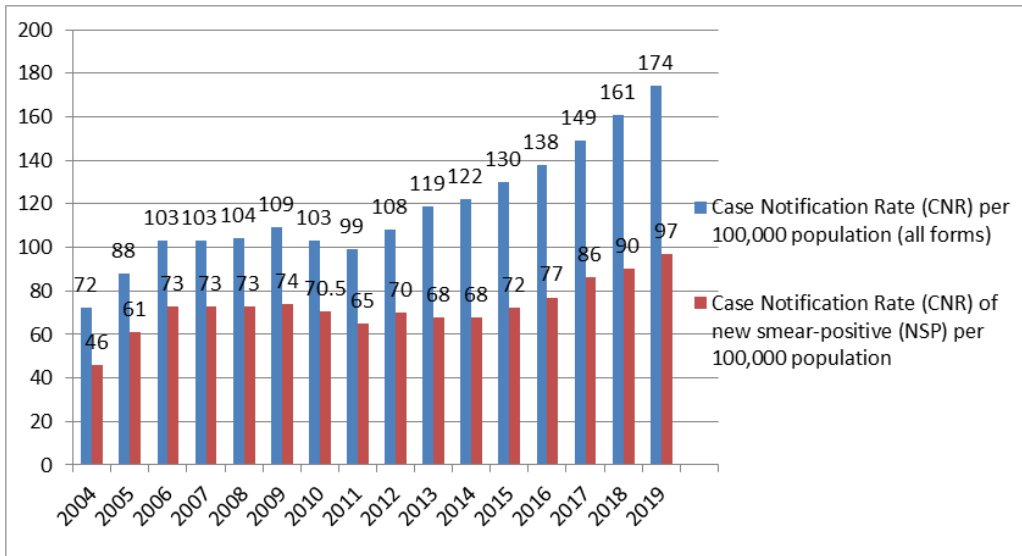


Figure-2: TB case notification during 2004-2019 [22]

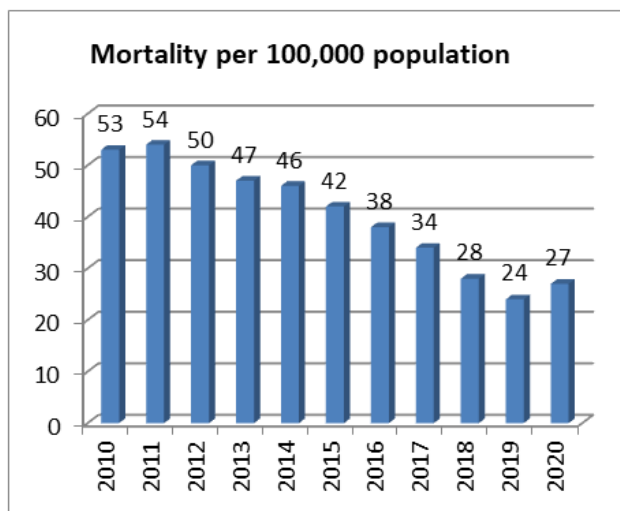


Figure-3: TB mortality per 100,000 population [8]

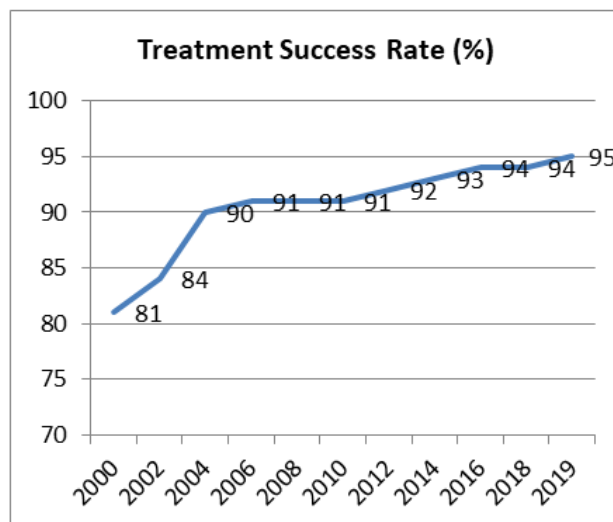


Figure-4: TB treatment success rate (%) [8]

In 2018, 75% of the detected TB cases were treated while in 2001 only 26% of detected TB cases were possible under treatment. The TB control programme reduced 50% of TB mortality in the last two decades. Bangladesh gained a success in TB treatment since 2005 (over 90%) which has increased by over 95% in 2019 [8] (Figure-4).

Since the adoption of the DOTS system in 1993, the National Tuberculosis Programme (NTP) in Bangladesh has continuously evolved and embraced new approaches and solutions to make the program more accessible, equitable, and effective. Key strengths include the implementation of shorter routine MDR treatment, the introduction of Xpert at the Upazila level, ongoing changes in diagnostic algorithms, and the extension of social and economic support to MDR, deprived people, and PLHIV living with TB. In addition, the introduction of a community-based TB control program with DOTS has enhanced overall efforts to combat TB. By combining top-down (DOTS) and bottom-up (community approach) approaches, policy makers, and NGOs worked together at the grassroots level to achieve success [51].

NGOs, especially BRAC, the leader of Community-Based TB Control, have made significant contributions in improving the knowledge of TB awareness among the general population. A study by Paul *et al.*, (2015) found that in BRAC-initiated community approach projects, about 97% of people have knowledge (53% good knowledge) that "tuberculosis is an infectious illness but curable, and early handling is important [52]". The DOTS strategy, combined with a community approach, can be effectively implemented in high tuberculosis burden areas of Bangladesh in the next stages. This success is due to the decentralization of sputum smear microscopy and treatment competence to marginal health services, utilizing the existing primary health care network. Case recognition should be further expanded by educating and involving the community in TB control efforts through social activation.

MDR-TB has been a major concern in Bangladesh due to its higher treatment cost, improved diagnosis, and sincere management. In 2013, there were 1.6% MDR cases in new TB cases and 29% in previously treated TB cases, which threatened the projected TB-end by 2035. However, the Public Private Mix (PPM) action by NTP, Bangladesh, has been successful in controlling MDR-TB within limits. The current estimated TB cases with MDR new cases are 1%, and previously treated cases are 4.8%, indicating that Bangladesh is on the right track [8]. Further GO-NGO partnerships through the community-based extension of DOTS for both drug-susceptible (DS) and drug-resistant (DR) TB have improved the quality of the program [22]. Therefore, the community-based TB control program has increased the capacity of the

central DOTS program towards the state strategy 'end TB strategy.' The integrated top-down with bottom-up community approach methods have shown significant success in reducing TB-ill health in Bangladesh over the last two decades [53]. Researchers Lorent *et al.*, (2014), Parija *et al.*, (2014), and Newell *et al.*, (2006) demonstrated the success of DOTS through integrated ways to control TB in Cambodia, India, and Nepal accordingly [27, 54, 55].

However, optimizing the diagnosis and treatment of latent TB infection (LTBI) is another key concern for achieving the 'End TB' targets for Bangladesh. Besides the WHO's 'End TB strategy,' which aims to decrease TB mortality by 95% and reduce fresh TB cases by 90% between 2015 and 2035, LTBI is a big obstacle to reaching the global target. Only 10% of infected individuals develop clinically active TB, while 90% remain in the latent phase. Achieving  $\geq 90$  LTBI treatment content by 2025 is, therefore, one of the crucial milestones set up by the WHO. A study by Islam *et al.*, (2016) found that parents' illiteracy, lower socio-economic status, large families, poor living conditions, and sharing the same indoor environment further increased the prevalence of LTBI among contacts. They observed that the incidence of LTBI among children with household contacts of TB patients was higher than non-contact children [28]. The study also observes that the NTP is not properly concerned about LTBI and lacks accurate data about it. Moreover, national health care workers are not giving proper attention regarding LTBI. They are not attaining the underline factors associated with it. NTP should initiate LTBI screening to high risk population like people lives in slum, transgender, drivers, sex worker and elderly people to prepare database for treatment, support and advice which is very important for check and balance in LTBI control. Therefore, if the TB controlling programme does not implement LTBI screening properly which may be the big obstacle to reach 'end TB strategy' in time?

### COVID 19 and TB Control Challenges

As of January 2020, despite the general effectiveness of tuberculosis control, the "COVID-19 pandemic" continues to be a significant global concern. It has adversely affected the TB control program, leading to a reduction in the number of TB diagnoses, disrupted treatment initiation, aggravated TB deaths, and restricted patient mobility, thereby hindering the 2035 TB eradication program. Even though 73% of the population is vaccinated [56], a substantial proportion of transgender, minority, and mobile populations remain unvaccinated against COVID-19, making them more susceptible to both corona and TB. Since both diseases affect the lungs and cause similar symptoms, cough, fever, and respiratory difficulties, the diagnoses and treatments for both diseases have been ignored. The delayed diagnosis and treatment of tuberculosis can result in a worsening of symptoms and an increase in

the risk of TB transmission in the local population [57]. In response, the National Tuberculosis Program (NTP) can use social media platforms such as Facebook, LinkedIn, Twitter, WhatsApp, Flickr, and YouTube to disseminate information regarding tuberculosis. The Directorate General of Health Services (DGHS) can also develop a mobile health (mHealth) approach to identify TB contact tracing, which may be more cost-effective in resource-limited settings and pandemic situations than the conventional paper-form-based approach. Previous studies have shown that social media for TB control activities can have a positive outcome, and mobile phones and social media can be significant tools for creating tuberculosis awareness, training, and community engagement in the country. Researcher Acha-Anyi *et al.*, [58], Sylverken *et al.*, [59] and Yoonhee *et al.*, (2016) [60] described a positive outcome by using social media for TB control activities. However, the ongoing COVID-19 pandemic could delay Bangladesh's goal of eliminating tuberculosis by 2035, which is a significant concern. Nonetheless, some researchers believe that COVID-19 could create a new opportunity to fight against TB. The pandemic has highlighted the importance of political will, sufficient finance for research and treatment, a faster response, as well as effective global public health governance [61]. It is anticipated that the lessons learned from the pandemic will be applied to enhancing TB research and development and achieving the ultimate TB strategy.

## 6. CONCLUSION

Having undergone the overall decline in tuberculosis (TB) incidence and mortality, TB continues to be a major public health concern in this country. The country has made substantial progress in controlling TB with the assistance of the WHO and other partners, implementing the DOTS strategy and increasing coverage, detection, and treatment success rates. According to study, the case detection rate (CDR) has reached 81%, treatment success has achieved 95%, and the mortality rate has been limited to 27 cases per 100,000 population. The study demonstrates that community-based approaches and GO-NGO partnership have accelerated the success of the DOTS strategy. However, the COVID-19 pandemic poses a significant threat to the TB control program's progress by 2035. To mitigate this threat, NTP should reinforce public-private partnerships, enhance access to TB services, and use social media during the pandemic.

Despite the progress made, the study reveals significant disparities and challenges in accessing TB care, particularly among vulnerable groups such as women, children, and the elderly. Besides, optimising the diagnosis and treatment of latent TB infection, PLHIV and MDR-TB are great concerns for Bangladesh. To address these challenges, the study recommends increased efforts to identify missing cases and integrate marginalized populations into national TB control measures, as well as prioritizing high-risk

groups such as sex workers, floating population, hard-to-reach groups and transgender individuals in TB screening. Additionally, the study highlights the need to address the social stigma surrounding TB, particularly for women, through awareness campaigns.

To continue making progress towards a TB-free Bangladesh, the study calls for a paradigm shift in TB response policies towards need-based and rights-based strategies that consider gender, ethnicity, age, and economic situation. Further, the study emphasizes the need for sufficient financing for research and treatment and the development of national public health governance for TB under one umbrella. Finally, in the words of the famous poet Robert Frost, Bangladesh still has "miles to go before [it] sleeps" in the fight against TB.

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