REVIEW ARTICLE

# Prevalence of Tuberculosis: Present Status and Overview of Its Control System in Bangladesh

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**ABSTRACT-** Tuberculosis (TB) is one of the major prevalent disease, which is caused by *Mycobacterium tuberculosis* and among all the diseases it exists in harmful condition. The long term cough with blood sputum and fever is the major symptom of tuberculosis. In 2014, 1.5 million TB patients were dead from the 9.6 million active TB patients. Every second someone in the world affected by *M. tuberculosis* and 10% of the affected people will be infected in their later period of life. The global scenario in terms of TB infection is varies from one country to another. Developing country like Bangladesh stands on much more harmful condition. According to WHO Global TB Report 2016, Bangladesh is one of the world's 30 high TB burden countries and near about 73, 000 people die annually due to Tuberculosis. In addition, Multi Drug Resistance Tuberculosis (MDR-TB) is increasingly affected the people and it is now a major concern for disease prevention. The infection chances of a HIV affected people are much higher than a healthy people in case of tuberculosis. Although, the infection rate of tuberculosis is increasing over the last few decades, but new anti-Tb drugs show greater audacity to eradicate critical situation of tuberculosis. Through the molecular analysis, researchers pointed out the *M. tuberculosis* resistance, which will give us effective result in the improvement of drug development. This review summarized the novel drugs, treatment phenomenon and overall condition of tuberculosis in Bangladesh.

**Key-words-** *Mycobacterium tuberculosis*, Multi Drug Resistance Tuberculosis, HIV, TB infection

## INTRODUCTION

Tuberculosis (TB) is one of the most virulent diseases, which caused by *Mycobacterium tuberculosis* (MTB) bacterium. From the ancient period, this disease has played troublesome preface of mankind [1]. It has been estimated that about one-third of world's population to be affected with TB and more than 95% patients died in developing countries [2]. Generally TB affects the lungs, but other parts of the body can also be affected [3]. The true sign of active TB are a long term cough with blood-containing sputum, fever, night sweats, and weight loss [4]. Robert Koch was discovered the causal agent *M. tuberculosis*, and awarded Nobel Prize in physiology or medicine in 1905 [5]. Tuberculosis germs transmitted from person to person through the air when they have active TB in their lungs cough, spit, speak, or sneeze [6]. Active TB is diagnosed by chest X-rays, as well as microscopic examination and culture of body fluids whereas tuberculin skin test (TST) or blood tests done in latent TB patient [7]. TB prevention comprises screening of those are at high infection risk, early detection and vaccination with the Bacillus Calmette-Guerin vaccine [8-9]. Over a long period of time multiple antibiotics required for TB treatment. After the Second World War the first anti-tuberculosis drugs were introduced and then more effective drugs following in the early 1950. During this time very worthy observational studies were conducted. This information provided details elaboration of disease progression without the influence of chemotherapy or human immunodeficiency virus (HIV) infection. TB subsequently collision the income bankrupt into poverty, the food deprived into a condition of further malnutrition [10]. Now *M. tuberculosis* can showed resistency against antimicrobial drugs. The two most

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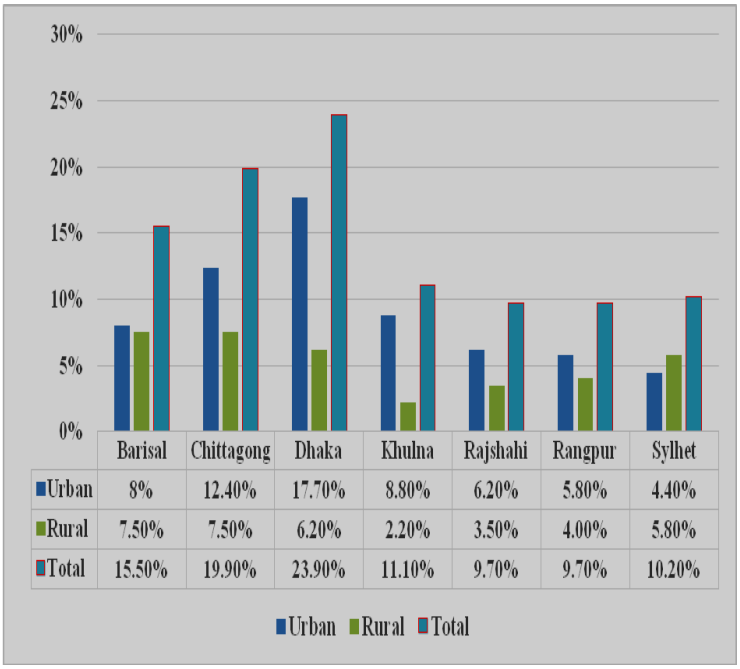
widely used TB drugs such as rifampicin and isoniazid cannot respond their efficacy against Multidrug-resistant tuberculosis (MDR-TB) [11]. In Bangladesh TB has been a major public health concern for last few decades. According to the World Health Organization (WHO), Bangladesh ranks seventh among the 30 highest TB-burdened countries [12]. Bangladesh made a remarkable progress in Directly Observed Treatment Short course (DOTS) implementation since it's been running in 1993. The country achieved a 100% DOTS coverage in 2003, the treatment success rate is persistently above 90% from 2000, and case detection rate for new smear positive pulmonary TB above 70% since 2006 [13]. The aims of this review were looked into the overall situation of TB disease in Bangladesh and highlight the present status of this disease, pathogenesis, treatment and control of TB, in order to better understand the disease.

**Global epidemiology-** TB is generally affected the humans from the beginning of their history and remains it's one of the leading causes of death worldwide contempt the spotting of fruitful and affordable chemotherapy more than 50 to 60 year ago [14-15]. According to WHO, TB is pandemic and among the fifteen countries where 13 are Africans, while half of the new cases are in six Asian countries with highest estimated TB incidence rates [16]. In 2007 there was an estimate 13.7 million chronic active cases [17], and 8.8 million new cases in 2010 and 1.45 million deaths mostly occur in developing countries [18]. Among these 0.35 million deaths occur in those co-infected with HIV [19]. In 2015, 1.8 million people out of 10.4 were affected and died by these diseases [20]. Histrionic progress was achieved Russia in its mortality rate from 61.9 per 0.1 million in 1965 to 2.7 per 0.1 million in 1993 [21]; however these rate increased to 24 per 0.1 million in 2015 and then rebound to 11 per 0.1 million by 2015 [22]. Across the globe TB distribution is not uniform; about 80% of the Africans, Caribbean, south Asian and Eastern Europe populations were tuberculin test positive, while only 5-10% of the U.S. population test positive [23]. In India, every year 0.5 million patients died due to pulmonary TB. The scientists try to find out the associated causes such oxidative stress, degenerative disease, and antioxidant status [24]. According to (WHO), during 2000-2015, India's estimated mortality rate dropped down from 55 to 36 per 0.1 million population per year with estimated 480 thousand people died of TB in 2015 [25]. In developed countries, TB is less common. In Europe, TB death fell from 500 out of 0.1 million in 1850 to 50 out of 0.1 million by 1950. When related antibiotics were come than these disease was reduced, although its remains a significant threat to public health, such that when the Medical Research Council was formed in Britain in 1913 [26]. In Canada, tuberculosis is still endemic in some rural areas [27].

**Bangladesh status-** In Bangladesh, the population migration is high and these population faces poverty, densely living and poorly living and working situation, all of these facts are allow TB spread. Beside these, many parts of the Bangladesh population has a general lack of consciousness about TB infection. 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 [28]. In case of Bangladesh, tuberculosis services were started in 1965 under numerous TB clinics and hospitals. In the first half of 80's TB treatment expanded 20% areas of the country, during the second health and population plan (1980-1986). Then, during the period of third health and population Plan (1986-1991) under the Mycobacterial Disease Control (MBDC) Directorate of the Directorate-General of Health Services (DGHS), TB services were operationally integrated with leprosy.




| | Barisal | Chittagong | Dhaka | Khulna | Rajshahi | Rangpur | Sylhet |
|---|---|---|---|---|---|---|---|
| Urban | 8% | 12.40% | 17.70% | 8.80% | 6.20% | 5.80% | 4.40% |
| Rural | 7.50% | 7.50% | 6.20% | 2.20% | 3.50% | 4.00% | 5.80% |
| Total | 15.50% | 19.90% | 23.90% | 11.10% | 9.70% | 9.70% | 10.20% |

**Fig. 1: Current situation of Tuberculosis (TB) in Bangladesh**

National tuberculosis control program (NTP) adopted the Directly Observed Chemotherapy, Short Course (or DOTS) strategy during the fourth population and health plan (1992-98) under the project of "Further Development of TB and Leprosy Control Services". In the mid-90's NTP initiated its field implementation and gradually expanded to cover most part of the country. In 2002, DOTS was expanded to Dhaka Metropolitan City and by 2003, 99% of the country's population was brought under DOTS services. However, the government of Bangladesh committed to intensify the DOTS program and linked up this program to the Millennium development Goals (MDGs) [29]. In addition, Bangladesh has a five-year National Strategic Plan for TB control (2015-2020) which reduce the prevalence of TB and increases the treatment success rate of at least 90% for all forms of TB. Noteworthy, this plan will be ensure the treatment of all multi drug resistant (MDR)-TB cases and aligned all private and public health providers [30].

**Kinds of Tuberculosis (TB)-** Mainly tuberculosis divided into two classes. One is pulmonary TB and another is extra-pulmonary TB. Pulmonary TB is categorized into some sub-classes. The *M. tuberculosis*, when developed on the edge of the lung rupture into space of pleura, it is tuberculosis pleurisy. In other cases, when bacteria destroy the progressive lung by cavity formation, it is cavitary TB. In case of miliary TB, bacteria affect the bloodstream. This form of TB can be rapidly fatal. In contrast to extra-pulmonary TB, it is mainly occurred in immuno-compromised patients [31]. Most of the cases kidney is affected by extra-pulmonary TB disease and renal tube is the most common organ for extra-pulmonary TB infection [32].

**Diagnosis of Tuberculosis (TB)-** The diagnosis system of TB can be done by different tests. In microbiological diagnosis section, it includes sputum, laryngeal swab, gastric washing, bronchoscopy, and PCR analysis. In radiography diagnosis section, it includes chest x-ray, CT scan, and FDG PET/CT tests. In immunological diagnosis part, it includes ALS assay, Transdermal patch, Tuberculin skin test, Mantoux skin test, and Heaf tests. In recent years, adenosine deaminase test, Nucleic acid amplification tests (NAAT), and Interferon-γ release assays is more effective for the diagnosis of TB. But these advanced diagnosis tests of TB is costly for developing country like Bangladesh [33].

**Tuberculosis (TB) drugs and its present situation in Bangladesh-** More than 20 drugs used for the treatment of tuberculosis disease. Among them most of the drugs developed more than 40 years ago. A very recent review by Islam et al. summarized some new anti-TB drugs target in *M. tuberculosis* [34]. Initial treatment of TB disease start with 4-drug regimen: isoniazid, rifampicin, pyrazinamide, and either ethambutol or streptomycin. After isolating susceptible TB, ethambutol or streptomycin can be discontinued [35].

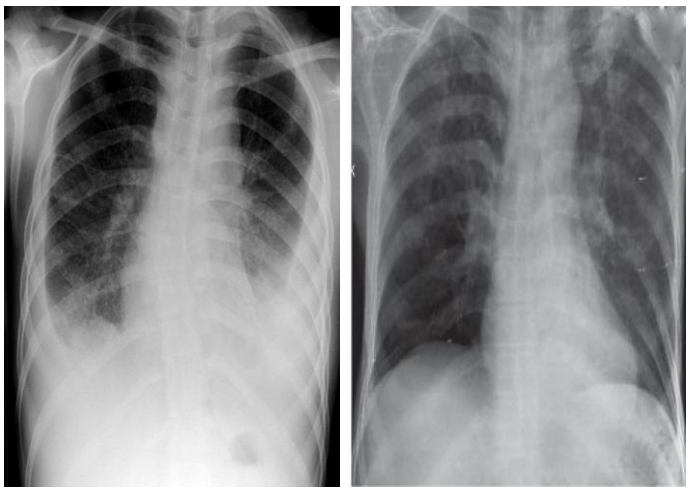


**Fig. 2: X-ray report of TB patient before and after treatment**

**Table 1: WHO recommended doses of the First line anti-TB drugs**

| Drugs | Daily doses (mg/kg) | Route | Thrice weekly dosage (mg/kg/dose) |
|---|---|---|---|
| **Isoniazid (H)** | 5 (4-6) | Oral | 10 (8-12) |
| **Rifampin (R)** | 10 (8-12) | Oral | 10 (8-12) |
| **Ethambutol (E)** | 15 (15-20) | Oral | 30 (25-35) |
| **Pyrazinamide (Z)** | 25 (25-30) | Oral | 35 (30-40) |
| **Streptomycin (S)** | 15 (12-18) | Oral | 15 (12-18) |

**Table 2: WHO recommended doses of the Second line anti-TB drugs**

| Drugs | Daily doses (mg/kg) | Route | Maximum daily dose |
|---|---|---|---|
| **Kanamycin (K)** | 15 | IM | Up to 1 gm |
| **Amikacin (A)** | 15 | IM | Up to 1 gm |
| **Ethionamide (Eto)** | 10-15 | Oral | Up to 1 gm |
| **Cycloserine (Cs)** | 10 | Oral | Up to 1 gm |
| **Para amino salicylic acid (PAS)** | 250 | Oral | Up to 1 gm |
| **Ofloxacin (Ofx)** | 15-20 | Oral | 800-10000 mg |
| **Levofloxacin** | 7.5-10 | Oral | 750-1000 mg |
| **Moxifloxacin** | 7.5-10 | Oral | 400 mg |

After two month of treatment, pyrazinamide can be stopped. Then, isoniazid plus rifampicin are continued for 4 more months. If isoniazid resistance is appeared stopped isoniazid and continue treatment with rifampicin, pyrazinamide, and ethambutol for the next 6 months. In case of Bangladesh, 9 to 12 month regimen marked to be effective for treating MDR-TB cases. It includes a primary phase of kanamycin, moxifloxacine, pyrazinamide, high-doses isoniazid, and ethambutol. Then, 5 months treatment of moxifloxacine, pyrazinamide, and ethambutol should be continued [36].

**HIV related Tuberculosis-** Human immunodeficiency virus (HIV) is one of the most threatening viruses for developing the AIDS [37]. Generally the virus affects our immune systems, particularly in T lymphocytes and macrophages, which operating cell mediated immunity in human body [38]. Infection with TB pathogen can occur

when an individual's exposed to an infectious case of TB inhales particles containing the tubercle bacilli [39]. In HIV infection, macrophage abnormally functions in response to TB infection, which may increase the susceptibility of TB disease [40]. Immuno competent individuals infected with *M. tuberculosis* have approximately a 10% lifetime risk of developing TB [41], with half of the risk occurring in the first 1-2 years after infection. In contrast, HIV-infected individuals with latent TB are approximately 20-30 times more likely to develop TB disease than those who are HIV uninfected, at a rate of 8-10% per year. [42]

## CONCLUSIONS

Tuberculosis disease has still prevalent in many countries like Bangladesh. But developing country faces many troubles to tackling tuberculosis disease, such as lower diagnostic opportunity, lesser quality of treatment and unavailability of advanced drugs. The national TB prevalence survey is considered to be another success of Bangladesh's against TB disease. Although, successful treatment rate against normal tuberculosis much lower than multi-drug resistance tuberculosis. So new era of drug lines shown complaisant respond against tuberculosis and prevent epidemic condition. In future, better technology, advanced diagnosis systems, skilled full manpower, enough funds, and well equipped laboratory will help us to achieve desired control and management systems against TB disease.

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