

## **A Review of Prevention and Control of Tuberculosis**

**Author:** Dr Aziz-ur-Rahman NIAZI

Department of Public Health and Infectious Diseases, Faculty  
of Medicine, Herat University

### **Abstract**

Tuberculosis (TB) is a common infectious disease that is found in all over the world. The causative agent of TB is *Mycobacterium tuberculosis*, which mainly affects the lung causing pulmonary tuberculosis. Sometimes, *Mycobacterium tuberculosis* can affect other body organs and causes TB of CNS, bones to name a few. TB is the leading cause of death caused by an infectious agent so far in the history. The World Health Organization (WHO) estimates that one-third of the world's population is infected with *Mycobacterium tuberculosis*, of which only 10% develop the active disease in some stage of their lives.

There are many ways to prevent the establishment and progress of TB in the community. The main focus of TB prevention and control programs are on the effective treatment of TB cases and eradication of TB in the community through directly observed treatment of TB patients. Moreover, other primary, secondary and tertiary prevention and control measures are very crucial to develop and implement to stop TB from spreading from one person to another in the community. Primary prevention and control measures aim to prevent disease before it occurs; secondary measures focus on reducing the impact of the diseases once it has already been established; and tertiary measures aim to de-

crease the impact of TB and prevent its complications. This way, not only TB is being controlled, but also, significant public health and economic advantages will be guaranteed for the community and the country.

**Key words: Primary prevention, secondary prevention, tertiary prevention, tuberculosis, DOTS**

### Introduction

Tuberculosis is a deadly and widespread infectious disease which is caused by *Mycobacterium tuberculosis*. It most commonly affects the lungs causing pulmonary TB, but can also affect Central Nerve System (CNS), the lymphatic system, the circulatory system, the genitourinary system, bones, joints and even skin.<sup>1</sup> Over one third of the world's population are suffering from latent TB infection (LTBI) and staggeringly in every second, one new case is being added to this community. Not all LTBI sufferers show the signs and symptoms of the disease. However, gradually one tenth of latent TB cases turns to active and if not treated establishes a significant case fatality rate.<sup>2-3</sup>

Moreover, WHO Global Tuberculosis Report (2016) indicates that in 2015, 10.4 million people developed active TB, of which 5.9 million (56%) were men, 3.5 million (34%) women and 1.0 million (10%) children. People living with HIV accounted for 1.2 million (11%) of these cases. In 2015, 1.8 million died of the disease, including 0.4 million deaths among HIV-positive patients.<sup>4</sup> It needs to be noted that an increasing number of people in developed countries are also contracting TB due to the use of immunosuppressive drugs, drug abuse and HIV/AIDS. The incidence of TB varies widely in the world and it is sometimes different even in neighboring countries due to applying different healthcare programs.<sup>5</sup>

Considering information given above, in 1993, *WHO declared TB as a global health emergency. In 2015, the Sustainable Development Goals (SDGs) for 2030 were adopted by the United Nations. One of the SDGs targets is to end the global TB epidemic. The WHO End TB Strategy which was approved by the World Health Assembly in 2014, calls for a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate by 2030, compared with 2015.*<sup>4</sup>

This article discusses the TB control measures and their unique features, focusing on primary, secondary and tertiary control measures appropriate for epidemic emergence of TB in a community. Also, it discusses the control measures suitable for TB in an endemic situation.

### Tuberculosis Control Measures and Their Unique Features

The prevention and control of TB infection takes two parallel steps.<sup>6</sup> In the first step, people with TB infection are identified and treated and in the second

step exposed people are vaccinated to be protected from TB infection. Despite its optimistic view, this guideline is effective in controlling TB. Subsequent studies confirmed this classification and provided more detailed guidelines for stopping the spread of TB. One of the most challenging issues about TB is its high tendency to transmit from one person to another particularly at hospitals. The 2005 CDC guidelines for TB control at hospitals and other health-care facilities have become the basis for all hospital TB control programs.<sup>7</sup> The 2005 guideline divided the implementation strategy into three approaches. Administrative interventions aiming to increase the isolation of suspected cases; development and maintenance of a TB control plan; and finally using personal protective equipment (PPE) for example masks and respirators to inhibit contacting TB bacteria. Upon applying all these points, the incidence of tuberculosis decreased by 20%. But soon after this success, the emergence of HIV put the control of TB in a complicated position. Many patients got drug-resistance TB because they did not take the correct dose of antituberculosis drugs regularly and for the prescribed duration. This challenged the TB control programs. Considering this, WHO decided to implement more sophisticated and effective control measures for controlling this threatening disease. It was decided that healthcare providers directly observe the patients while taking their antituberculosis medications, to ensure the adherence of TB treatment regime. Thus, a sensible program by the name of DOTS (Directly Observed Treatment, Short course) was introduced.

The principle of DOTS is to directly observe the patients taking their medication and to ensure that medications are taken properly, in the right combination and for the prescribed duration.<sup>4</sup> This WHO-recommended TB control strategy combines and focuses on five components. Government commitment, detection of cases by sputum smear microscopy, application of the standardized treatment regimen emphasizing on direct observation of the treatment for at least first two months, regular drug supply for the patients to ensure that medication and treatment are not interrupted, and finally the assessment of treatment result by a standardized reporting and recoding system. Recently the new six-points shared this success. These six components of Stop TB Strategy for controlling TB for the mentioned period are:

1. Pursuing high-quality DOTS expansion and enhancement
2. Addressing TB/HIV, MDR-TB and other challenges
3. Contributing to health system strengthening and TB prevention services
4. Universal health coverage, social protection and addressing social determinants
5. TB financing
- TB research and development

This program is to be implemented for the 15 years (2015-2030) as was planned in the WHO End TB Strategy, approved by the World Health Assembly in 2014.<sup>4</sup>

The deadly nature of TB, invoked many thoughts to consider effective ways to cope with this threatening disease. Apparently, DOTS strategy seems to be the most effective way of treatment, control and prevention of TB in the society. In addition to DOTS strategy, there are many other control measures designed for TB which can be classified into three categories: primary, secondary and tertiary prevention. Below is a short description of the control measures in each of these three categories.

### **Primary Prevention Measures of Tuberculosis**

Primary prevention is the prevention of the onset of disease in susceptible individuals through promotion of healthcare and specific protection, such as immunization. Bannister et al. (2006, 507) define primary prevention as the prevention of infection or disease generally requiring community-wide public health measures. Some of the primary prevention controls for TB are as follow:<sup>4</sup>

1. Early diagnosis and introducing of cases both latent and symptomatic TBs, to reduce the infectivity period,<sup>8</sup>
2. Preventing contact between susceptible and source of infection (isolation),
3. Altering the number of immune people in the community (immunization, BCG vaccine),<sup>9</sup>
4. Administration of prophylactic therapy for people who are at risk or susceptible,
5. Contact tracing of individuals who are in close contact with cases,
6. Reducing the risk of transmission during a contact between infected individual and a susceptible (using personal protective equipment, mask and respirator),
7. Mandatory annual skin testing for all inmates,
8. Sanitation and good nutrition,<sup>10</sup>
9. Prompt medical evaluation of persons with symptoms suggestive of TB,
10. Identification and immediate isolation of cases in crowded environments such as school, barracks, prisons for developing any symptoms of TB,
11. If a new case is identified in an area, conducting an investigation in that area and extending the investigation to second circle and if required to third circle,
12. Using effective local exhaustive ventilation and,  
Screening for the presence of TB infection and early recognition of TB

symptoms, utilizing procedures such as Tuberculin skin tests, chest x-ray, and sputum examinations followed by prompt medical evaluation and intervention.

Early success in primary prevention is the result of activities directed at preventing the occurrence of TB in the society.<sup>10</sup> Moreover, before anti-tuberculosis drugs became available optimal nutrition and good housing contributed greatly to decrease incidence of tuberculosis in Western Europe, but prompt diagnosis and treatment remain the most effective means of controlling tuberculosis.<sup>4</sup> Meanwhile, BCG vaccination provides a reasonable degree of protection against tuberculosis in infants and non-infected children. In the United Kingdom, at a time when tuberculosis was more common, BCG vaccination of adolescents was 70-80% effective in reducing the incidence of all forms of tuberculosis later in life.<sup>11</sup>

### **Secondary Prevention Measures of Tuberculosis**

Secondary prevention focuses on Identifying and treating people with established disease. It is also defined as an early treatment of infection in people whose TB is confirmed by laboratory tests, e.g. Tuberculin Skin Test, and the prevention of possible complications of the infection or disease.<sup>12</sup> Some secondary prevention controls for TB are as follows:<sup>13-14</sup>

1. Early detection and prompt antibiotic treatment of confirmed and suspected TB cases,
2. Decreasing the intensity and preventing complications,
3. Contact investigation,
4. Effective surveillance

Outbreak investigation and management

The purpose of the secondary prevention is to detect early symptoms about which the patient is unaware so that prompt intervention can be considered for control or cure.<sup>13-14</sup>

### **Tertiary Prevention Measures of Tuberculosis**

Tertiary prevention commonly includes the prevention of the disease progression and complications after it is clinically noticeable and the diagnosis has been established. It also includes the prevention of re-occurrence of the disease, re-infection and possible disabilities of the disease (in the lung).<sup>12</sup> Some tertiary control measures of TB are as follow:<sup>11-14</sup>

1. Effective treatment of active infection,
2. Management of post-infection disorders,
3. Eliminating the patients' sputum and assuring a hygienic condition of environment,

Follow-up of the previous confirmed treated patients for a period of at least 6 months.

All above-mentioned control measures are optimal when there is an out-

break of the TB infection.<sup>15-16</sup> In the case of an established endemic TB infection, most mentioned control measures are still needed. In case of endemic TB, the disease has already passed and might probably missed the level of primary and possibly secondary prevention measures; so it is wise to think about the treatment of the cases, elimination of the disease and where possible prevent its complications and disabilities. Although it seems very challenging to eliminate TB, still it should be controlled to prevent developing new cases and cause new victims. As it was discussed earlier, the WHO Stop TB Strategy has decided to eliminate TB from the world in 2050. It seems that now that WHO End TB Strategy which was approved by the World Health Assembly in 2014, has developed strategies to significantly reduce the mortality and morbidity of disease by 2030.<sup>15-16</sup>

### Conclusion

By implementing the various primary, secondary and tertiary control measures of TB diseases, authorities are optimistic of eliminating this threatening deadly infectious disease. In this connection, the role of DOTS program which is one of the unique features of TB control measures can not be ignored. The expansion of directly observed treatment of TB patients has recently expanded and resulted in a great decrease in the incidence of TB in recent years. In addition to the implementing of DOTS strategy, other control measures, such as prophylactic therapy of suspected individual, and immunization of children in the area where TB is endemic, is crucial in controlling TB. People who have close contact with TB cases should be closely observed and screened to ensure that they don't have the infection because sometime the infection is simply latent and shows no symptoms.

Finally, educating people about TB, its severe symptoms and complication, its deadly nature, and the fact that it can be treated and eliminated is an essential theme that should be considered and enthusiastically implemented. By implementing all this we can hope that one day in the future TB will not be a public health issue and its incidence and prevalence will be minimized to nearly zero.

### Recommendations

Since tuberculosis is established in Afghanistan for millennia, and still it causes thousands of cases and victims every year, it is very important to follow the universal prevention measures developed and proposed by the World Health Organization and other global health-oriented bodies. Some of the measures that should be implemented in Afghanistan to prevent further spread of TB in the Afghanistan:

1. Contact tracing and diagnosis of latent TB infection
  2. Treatment of latent TB infection
  3. Early detection and treatment of active TB under DOTS program with standard antituberculosis drugs and for specified duration
  4. Reducing the risk of transmission from patients to healthy individuals
  5. Having protein- and vitamin-rich diet
  6. Observing appropriate sanitation
  7. Outbreak investigation and management
  8. Management of post-infection disorders and complication
- Eliminating patient's sputum and other clinical samples in hygienic conditions

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