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REVIEW

# Tuberculosis control in Sindh, Pakistan: Critical analysis of its implementation<sup>☆</sup>



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## KEYWORDS

Tuberculosis (TB);  
Prevention control;  
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**Summary** Tuberculosis (TB) remains one of the main health problems despite preventive and control measures that have been taken in the past few decades. It is responsible for almost 8.8 million cases and 1.4 million deaths around the world. Lack of access to TB services is a barrier for empowering TB patients. In a country like Pakistan, controlling TB has become a challenge because of the lack of private sector involvement in a National Tuberculosis Control Program (NTP). Therefore, collaboration is needed between public, private and government sectors in treating TB as well as in improving the quality of the health care system.

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## Introduction

Tuberculosis (TB) remains one of the main health problems despite preventive and control measures that have been taken in the past few decades [1]. It is responsible for almost 8.8 million cases and 1.4 million deaths around the world [2]. The World Health Organization (WHO) defines TB as “An infectious bacterial disease caused by *Mycobacterium tuberculosis*, which most commonly affects the lungs. It is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease” [1]. This paper is divided into four sections. The first section uncovers the nature of TB and its threat to public health in the Sindh province of Pakistan; additionally, a critical analysis of TB data in the National Tuberculosis Control Program report in Pakistan is presented. The second section highlights health protection strategies focusing on the epidemiological triangle. The third section describes a strategic plan for health improvement solutions in the Sindh province and provides suggestions for TB control strategies. Finally, recommendations are provided on how private and public sector collaboration on TB control can enhance TB prevention and control, contributing to strengthening health promotion strategies throughout the entire country.

## Nature of the threat to public health

### Prevalence and incidence

Pakistan, with 179.2 million people [3], is ranked fifth among the twenty-two countries that are extremely burdened by TB and accounts for 63% of the TB cases in the Eastern Mediterranean Region [4]. Moreover, the National TB Control Program (NTP) [5] estimates that approximately 413,450 TB cases (all types) occur in Pakistan every year, with an incidence of 231/100,000 people. According to the NTP [5], the prevalence of TB in Pakistan is 630,000 cases (at 364/100,000 people), with mortality rates in the range of 60,000 (34/100,000 people). TB cases in different provinces of Pakistan are documented via notifications, and these notifications are considered to be a proxy for incidence rates [6].

The Sindh province, with an estimated population of 42.4 million people in 2010 [7], has roughly equal rural and urban populations (51.2% and 48.8%, respectively). While Sindh has 23 districts, there are very limited studies and data on TB for any of those districts in the WHO, World Bank or any

National TB control organizations including provincial health ministries in Pakistan. According to Javaid [8], TB control was almost absent because of a dormant and ineffective NTP until 2001. Javaid [8] notes that this inefficiency is also associated with the lack of government commitment to fund and offer support for conducting TB programs around Pakistan.

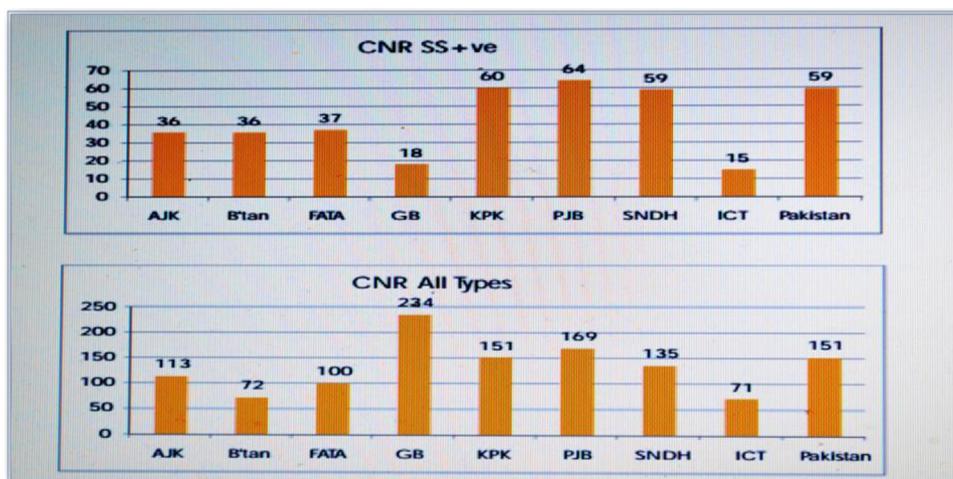
Graph 1 shows that the Case Notification Rate (CNR) for National Sample Survey (NSS)<sup>1</sup> + 2 cases in Sindh was 59 per 100,000 during 2011, and the CNR for all type of cases in Sindh remained at 135 during the same year. The data have been investigated by the NTP under the supervision of the provincial government of Pakistan.

According to the NTP report [5], a comparison of the CNR from 2010 to 2011 indicates that among 23 districts in the Sindh province, there was an increase in the CNR of Sputum Smear-positive (SS+) cases in 11 districts and a decrease in 12 districts. Sindh has a higher CNR among males compared to females aged 15 or more years old. However, while the NTP survey in 2011 involves adults 15 years and older, it raises a question about the age group below 15 years old that has not been taken into account.

Studies of TB conducted in different cities of the Sindh province have relied on a very small population, old literature and the NTP data in general [9]. While the NTP is covering a larger population (e.g., Sindh), it also relies on WHO estimates. For example, the NTP is not giving any data in the district level. Perhaps, the reason why NTP has been conducting TB survey by province is because of the high cost and often challenging logistics of conducting TB surveys or studies on the city/town/district level. Hence, the validity of the data remains questionable.

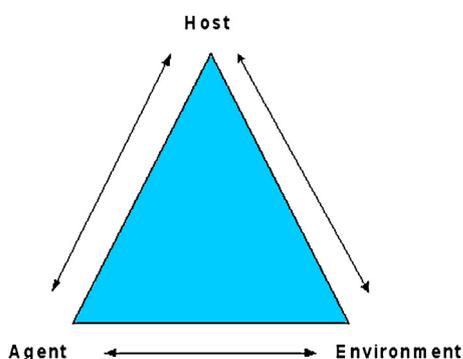
NTP is controlled by the government; therefore, it has some socio-political influence. For example, would the government want to reveal all data? According to Akhtar [10], health sectors in Pakistan base their TB detection on self-reporting, which follows smear testing of several suspected cases [10]. Moreover, in Pakistan, because of the insufficiency of disease inspections, precise data for TB incidence, prevalence and associated mortality are not easily accessed [11]. As per the NTP report [5], updated results on the TB survey were expected in mid-2012; however, there has been no available

<sup>1</sup> “A sputum smear-positive (ss+) patient is a patient with at least two sputum specimens that give a positive result for acid-fast *M. tuberculosis* bacilli by Ziehl–Neelsen microscopy or with at least one sputum specimen that is positive for acid-fast bacilli, and radiographic abnormalities consistent with active pulmonary TB” [2].



**Graph 1** Province-wise CNR per 100,000 for NSS± and all types of TB cases in 2011.

Source: NTP (2011).



**Figure 1** Epidemiologic triangle model of disease causation.

Source: Mausner and Kramer (1985).

data until now. Hence, timeliness is an issue along with missing data.

Of note, the WHO estimates are based on several assumptions regarding Pakistan, which may not essentially hold in overcrowded and peri-urban underdeveloped settings [12]. National notification data often does not disclose the vast burden of TB among these deprived populations [13].

### Risk factors and causal relationship

According to Gerstman [14], the epidemiological triangle model of causation (Fig. 1) can be used to understand the risk factors associated with tuberculosis. It shows that an agent, e.g., bacillus is insufficient to cause disease in most people. In many people, bacillus survives harmlessly in the body of the host. The two other angles, the host and the environmental factors, are also involved in the causation process. The interaction of all of

these factors together increases the likelihood of tuberculosis [15]. Using the triangle model of causation (Fig. 1), this section will uncover (a) different risk factors affecting holistic health and (b) social determinants and causal relationships associated with TB in the Sindh province of Pakistan. It will be evident that the agent, host and environment impact the holistic health of the population.

### Agent

Agent causing TB is *Mycobacterium tuberculosis*, which is an acid-fast, Gram-positive, aerobic, non-motile, rod-shaped organism [16].

**HIV/AIDS.** HIV infection, by damaging cell mediated immunity, resulted in a unique patient susceptibility to tuberculosis infection. The epidemiology of TB has changed in areas where HIV infection is noted as being prevalent, especially in South Asian countries where TB was already endemic. Hasnain et al. [17] states that approximately 30% of HIV patients were suffering from TB during screening.

### Host

Man is the TB host. There are different host factors that make man susceptible to the disease.

**Health behavior: smoking.** The established dose–response relationship with current cigarette smoking and tuberculin positivity is consistent with the knowledge that tobacco smoking increases the risk of TB transmission [18]. According to Siddiqui et al. [19], in one of the cities in the Sindh province, 48.8% of the people addicted to smoking had a TB infection. Environmental and host factors such as smoking increase the chances of TB.

*Drinking alcohol.* Quantifying the risk for TB with alcohol consumption is one of the most difficult factors. This could be because of patients' unwillingness to admit the pattern of their alcohol consumption and other existing factors related to alcohol abuse, e.g., homelessness and smoking. Poor nutrition and alcohol consumption lead to an immunity failure, as there is a limited association between TB and excess alcohol consumption [20].

*Diabetes.* Patients with diabetes have an increased risk of contracting tuberculosis compared to non-diabetic patients [21]. As Wang et al. [21] noted, there is a strong linkage between diabetes mellitus and pulmonary TB, especially between populations with low socio-economic status. This raises a concern about both diseases being prevalent during the same time period, enhancing the major public health problem. Qayum et al. [22] found that the prevalence of TB among diabetic patients is higher than non-diabetic patients in rural areas of Pakistan; however, there is no data available on diabetic patients with TB on the district level.

*Age.* Any age group is prone to TB, including infants and children. Substantial numbers of infants and children suffer from severe forms of infection such as miliary tuberculosis, which is contracted because of immunologic immaturity [23]. The NTP does not provide data on TB associated with infants aged 15 years old and below. However, according to Safdar [24], 38% of the total population in Pakistan is aged between 0 and 14 years old (in 2007); among these groups, 3460 cases (4%) were noted to have a TB infection.

*Lack of education.* Those with no formal education are more likely to have TB infection; lack of formal education may be a proxy for low socio-economic status. The weak National TB Control Program system often results in misconceptions and false beliefs among TB patients in Pakistan, especially in rural areas of Sindh. These myths have turned TB into a social stigma [25]. This stigmatization has a negative impact on patients and makes them reluctant to seek treatment [26]. According to Agboatwalla [9], knowledge about (Bacillus Calmette-Guerin) BCG as a preventive measure against tuberculosis among rural females and males was very limited in Sindh. However, a substantial number of rural males and females had little knowledge of how to protect against TB.

*Gender.* Sindh has a higher CNR among males compared to females. However, in other provinces of Pakistan such as Balochistan, Khyber Pakhtunkhwa (KPK), FATA, and Gilgit Baltistan (GP), the CNR is higher among females [5]. It must be noted

that these provinces of Pakistan practice cultural and traditional limitations by male dominance and negative behavior in terms of accessing health facilities. Perhaps this shows that traditional limitations can be a cause of inadequate access to health facilities and disease prevention. While these provinces are least socio-economically developed, female empowerment, travel and education are a matter of concern [25,26].

*Pregnancy.* Quantifying risk associated with pregnancy is somewhat challenging [27]. While there are anecdotal indications suggesting that pregnancy increases the susceptibility to TB [28], other anecdotal evidence finds that pregnancy is protection against TB [29]. A recent data review concluded that there is no real objective evidence for or against an association between pregnancy and susceptibility to TB.

## Environment

*Socio economic status.* Sindh is one cosmopolitan province in Pakistan and is characterized by a wide gap between rich and poor people with unequal access to health care. Residents of low-income neighborhoods, for example, suffer from overcrowding and malnutrition. Hence, they are predisposed to developing tuberculosis [12]. Currently, little empirical data are available on the prevalence and/or incidence of pulmonary tuberculosis among the residents of such marginalized settings in Pakistan [30].

*Closed living conditions.* The Sindh province has the highest population rate in urban areas; poor socio-economic conditions are prevalent in rural areas [31]. This over-crowdedness is also noted in the prisons of Sindh, with an environment based on poor and closed living conditions, inadequate ventilation, lack of proper nutrition and poor health status [32]. Infection in prison settings poses a threat not only for those who are imprisoned but also for society at large [33]. Transmission of TB in prisons is also particularly dangerous because it often involves resistant strains. Although there were not enough data on TB in prisons, effective TB infection control in prisons is necessary to protect the wellbeing of both prisoners and the wider community.

*Emergency and humanitarian crises in the province.* In 2010, almost 8 million people were affected as a result of flooding in Sindh; the flooding had a significant impact on accessing health care. This is perhaps one of the reasons why between 2010 and 2011, TB case notification increased in Sindh [5,34].

**Table 1** Control of tuberculosis: triangle and levels of prevention.

	Agent	Host	Environment
Primary	Vaccination (BCG)	Health education	Decrease crowding
Secondary	Early diagnoses (Tuberculin Skin Test (TST), chest X rays and sputum examination.	TB medications	Isolation of the patient during first week
Tertiary	Nil	Rehabilitation; TB medication; DOT	Restriction from daily activities

## Health protection strategies

The epidemiological triangle can be combined with the schema of the levels of prevention to devise a comprehensive framework for implementing preventive actions [15]. This section will explain and critique the primary, secondary and tertiary levels of prevention, referencing the Sindh province.

*Primary prevention* is an action to prevent a disease or problem from happening [15]. Given the levels of prevention (Table 1), the government has to provide free BCG vaccines to control TB and strengthen health education in different communities.

*Secondary prevention* involves early identification of the infected people to stop damaging effects [15]. Given the secondary level of prevention (Table 1), a survey conducted in 1996 showed that approximately 80% of TB patients first seek care from the private sector (general practitioners) in the Sindh province [35]. They were fair in refereeing and recognizing tuberculosis, but their case management and diagnostic procedures were quite weak. In addition, the health ministry should evaluate the knowledge, attitude and practice of general practitioners as well as provide continuing medical training for treating tuberculosis [35,36]. Isolation of a TB patient is justified in the first weeks of anti-TB treatment.

*Tertiary prevention* is an action that involves treating people who have already developed a disease [15]. A Directly Observed Treatment, Short-course (DOTS) strategy adopted recently in Pakistan is the most widely accepted mode of tuberculosis control. It involves administration of TB drugs under supervision and daily visits by TB patients to hospitals for taking drugs. In the rural area of Sindh, women are not allowed to visit health care facilities alone because of traditional barriers; therefore, female community health workers can be trained to serve other females in controlling and treating TB [9].

Given the three levels of prevention, the provincial government of Sindh needs to:

- Eliminate overcrowding and poor ventilated places [37].
- Improve strategies for detecting TB programs [10].
- Ensure TB infection control in healthcare settings where diabetes and other diseases are managed [2].

## Strategic plan for health improvement solutions

TB is a serious infectious disease that calls for urgent attention in the Sindh province. International communities, non-governmental organizations (NGOs), and civil society, together with the government, have to collaborate to incorporate different public health strategies. According to Vermund et al. [38], Pakistan spends a very small amount of its gross domestic product (GDP) on health care, and public health researchers are exceedingly few. Vermund et al. [38] argues that the scarcity of health resources in Pakistan and the weak government commitment to health care results in ignoring the detection and prevention of many communicable diseases. Hence, the role of government is:

- To put health care as the government's primary agenda and invest in health promotion projects around the country [39].
- Provide education and literacy programs [39].
- Strengthen female empowerment and remove cultural barriers to accessing proper sanitation [40].

What can NTP and the private sector do?

- Understand that access to health care is a basic human right [41].
- Suggest and implement policies related to accessing adequate health and health promotion by working together with the community [42].

## Conclusion and recommendation

The lack of access to TB services is a barrier for empowering TB patients. According to NTP [5], because of the lack of private sector involvement in NTP, it became problematic to control TB in Pakistan. Therefore, collaboration is needed between public, private and government sectors in treating TB as well as in improving the quality of the health care system [43]. Countries like Pakistan should build close collaborations with international communities and NGOs to prioritize health issues [44]. Perhaps different TB programs can impact the content and results of TB empowerment strategies. According to Sen [45], employing a capability approach for involving related communities in their services is important. Hence, this approach might be helpful to tackle different issues such as disparity in prevalence across gender.

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## Competing interests

None declared.

## Ethical approval

Not required.

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