



# Prevalence and risk factors of tuberculosis in developing countries through health care workers

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## ABSTRACT

In the last two decades, tuberculosis (TB) have threatened the public across the globe and continuing new TB cases and their transmission pooled with the global emergence of drug-resistant strains present an enduring occupational risk for health care workers (HCWs). Since last decade, government and funding agencies has given a significant amount of funds to tackle the problem of TB infection among medical staff or HCW in hospitals of developing countries, but the effects of these efforts have not yet been reported. Working environments are the major risk factors for TB infections among the HCW in hospital settings. Twenty-two high burden countries endorsed to the preponderance of worldwide tuberculosis cases in 2015. Urgent preventive strategies and mediations are needed to ensure the safety and sustained availability of these exquisite healthcare resources. This timeline review will provide the theoretical basis of high TB burden among the HCW which can be used for further improvement in strategies for the prevention of TB infections in hospital settings and provide a reliable basis for improving the personal health of HCW or medical staff.

## 1. Introduction

Tuberculosis (TB) is a major cause of debility and instability. It is estimated that from 2002 to 2020, approximately 1000 million people will be newly infected [1]. As per the Global TB report, 24 percent of world tuberculosis cases (approximately 28, 00,000), has been reported in India in 2017 [2]. With a population of 1.35 billion, India has the highest burden of TB and Drug Resistant TB (DR-TB) in the world. We have suggested the potential diagnostics and therapeutics strategies to combat the drug resistance TB [3,4]. Population size and annual number of incident TB cases remained unrelated in 2016 from under 10 per 100,000 populations in most high-income countries to 150–300 in most of the 30 high TB burden countries, and above 500 in a few countries including the Democratic People's Republic of Korea, Lesotho, Mozambique, the Philippines and South Africa [5]. If this conditions remains same and strong effective measures are not taken over 150 million people will become sick, and 36 million will die from TB [6]. Transmission of TB could be from patient-to-health care worker (HCW), patient-to patient, and HCW-to-patient. Mostly chances of *Mycobacterium tuberculosis* (*M. tuberculosis*) transmission to HCWs are in patient care (e.g., HCWs in emergency departments [EDs], inpatient medical wards, and inpatient HIV wards) compared to autopsies wound

irrigation, bronchoscopy and in the intensive care setting has been recognized [7,8]. Spread of aerosolized droplet by infected patient with active pulmonary TB results in transmission of DR strain of *M. tuberculosis* [9]. Condition get worse when person undertaking improper treatment or is unrecognized as a TB patient. People from healthcare setting, occupational category, individual susceptibility/immune status are at high risk of getting infected in these aforementioned conditions [10].

## 2. HCWs: at front lines of risk

In contemporary studies concerning Tuberculosis Infection (TI) among HCWs in countries with low incidence of TB, it is found that people are still at a high risk for TB among those who work in certain areas [11]. One reason could be the delayed diagnosis [12] while another elucidation could be an increase of immigrants HCWs who come from countries with a high prevalence of TB [13]. India has the world's highest rate of TB and Multidrug-Resistant (MDR) TB; TB incidence is 167 cases/100,000 person-years. Occupational TB risk is prominent worldwide; however, inadequate accessible data suggests that health-care workers [14] may be at a higher risk in India and other developing countries. Although, the World Health Organization (WHO) has long

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endorsed infection control guidelines for TB prevention among HCWs, global execution of these guidelines has been suboptimal. To prioritize improved local enactment of WHO guidelines, detailing TB risk among HCWs is urgently needed [15,16].

Several major nosocomial TB outbreaks were reported and scientific interest on healthcare-associated transmission of *M. tuberculosis* was re-stimulated [17,18]. Clinicians and other paramedical staff involved in diagnosis and care of these patients are likely to be more susceptible to mycobacteria. Although the issue has never been openly or seriously discussed, there is a need to be aware of these risks. India has a health care work force of over 4.3 million serving a population of over 1.2 billion. These HCWs are involved in health care facilities at various levels ranging from tertiary to primary health services and community-based outreach services [19–21]. Health care workers in the public sector encompass a major part of this workforce [22]. Eighteen national health programs, along with various state run health programs, exist in urban, rural, and tribal areas in India, all of which actively involve public HCWs who may be exposed to a variety of workplace hazards including biological, chemical, physical, radiological, safety, ergonomic, and psychosocial hazards [18]. Studies have shown the predominance of occupational related diseases in hospital-based HCWs including tuberculosis, hepatitis and contact dermatitis, finding an association between occupational hazards and disease incidence. While the health effects of occupational hazards are known, their prevalence in Indian public health care facilities is unknown [23]. However, without adequate support to recognize and manage occupational risks and consequential health impairments, there are scarce possibilities to meet the snowballing challenges in health care delivery, predominantly in India where severe shortages in human resources for health are projected [16].

Several studies on the rate of TB infection in medical trainees have been exists in India. In a report, 26 cases of TB were reported among 662 medical trainees at Pune and among them few are infected with DR-TB and MDR-TB [15]. Apart from this another observation came into front that medical student above 23 years of age were more prone to TB infection compared to those below 20 years [24]. HCWs in spite being exceedingly valuable national asset, they have to work on resource poor setting. Policy maker, till date fails to educate and allocate resources to defend healthcare facilities which in turn protect HCW's other than adding risk to their lives [15].

In most resource-poor settings, HCWs are in short supply and should be considered an exceedingly valuable national asset. If not taken care DR-TB may spread and cause mass panic. Since HCW's are on front line of care, any infection or transmission of disease to them will not only risk their lives but will also risk the lives of patients [25]. Large number of TB cases and limited resource provided to HCW's, make TB serious public threat. Implementation of well-organized TB investigation and infection control program in hospitals could play an important role to avoid the spread of TB infections [26]. Everything possible should be done to protect and retain the HCW resource through active interventions to reduce the risk of occupational TB [25]. Even in the absence of costly commerce controls, these programs should highlight the prominence of administrative controls to ensure early identification and isolation of potentially infectious TB patients as well as prompt diagnosis of symptomatic HCWs [7]. Regulatory tactics to recover workplace safety and health have their own limits. Some conventions face little conflict from those who are delimited; others are not accepted and worsen years of grievance. Policymakers are frequently challenged for not passably weighing the anticipated benefits of directive against the estimated costs. Some regulations are relatively economical, easy to monitor, and enforce, but others are not. In any case, enactment of regulations as intended cannot be assumed [27].

### 3. Work place infection control measures

Studies of health care linked transmission often place emphasis on

HCWs as a likeness of TB transmission rates stirring in health care facilities. This type of risk in low and middle-income countries must be addressed with work place infection control measures premeditated to shelter the health of both patients and those entrusted with their care. HCWs have the worrisome latent to transmit TB to patients when not aware or afraid to disclose their disease because of stigma and engagement apprehensions. HCWs also represent a populace of special concern because highly trained nurses and clinical staff are often in short supply in the developing world; the limited workforce is further threatened by both TB and fear of acquiring TB [28].

Disgrace, fed by a blend of distress and denial, exaggerates adjournments in diagnosis and treatment. When HCWs infected with TB and are diagnosed, they often seek secret treatment. Apprehensive of public revelation of their TB diagnosis, they fear a backlash from colleagues, who themselves are afraid of contracting TB [29]. Among TB patients, it has been shown that disclosure is more likely to occur when the patient is assured that they will not be stigmatized. Career allegations of TB identification also play a role in discouraging disclosure and driving stigma. Healthcare work in developing countries is challenging, due to generally low salaries and poor working conditions [30]. Restriction of immigration status due to diseased condition of HCW is also an important factor why these people in high income countries may not disclose their TB diagnosis results [10].

The relation of TB to profession can be roughly classified into three categories: 1. Occupations involving workers who are themselves at high risk of TB, like workers with less favorable socio-economic conditions: unskilled laborers and lower-paid workers. 2. Occupation that increase the risk of infection by contagious organisms if not disposed properly and people working in such pre disposed site are at high risk. 3. Occupations that increase the chance of exposure to infection in environments conducive to transmission: working in hospitals, mycobacteriology laboratories, and autopsy rooms.

### 4. Reason that increase the looming of TB transmission to HCWs

A systematic review of TB incidence in low- and middle-income countries estimated the annual risk of TB infection in HCWs to range from 3.9% to 14.3% (with between 2.6% and 11.3% attributable to occupational exposure). A subsequent meta-analysis estimated that the average annual risk of developing TB disease was three times higher (95% confidence interval 2.43–3.51) for HCWs (across all settings) compared to the general population. A delay in DR-TB diagnosis, less effective treatment for DR-TB, and longer periods of healthcare contact for DR-TB patients, increased the potential for transmission of DR-TB strains to HCWs. Due to delayed diagnosis and poor treatment of patients, HCW infected with extremely drug resistant TB (XDR-TB) are six times more likely to be admitted in hospital as compared to people which are taking care of them [10].

Although authenticating transmission in high-prevalence areas is difficult because of the prevalent communal transmission, a small number of studies in developing countries in Africa, Asia, and Latin America suggest that there is a high risk of acquiring TB infection among HCWs in health care settings. Most of these studies have recognized Tuberculin Skin Test (TST) adaptation among HCWs, with active TB developing in a few, and have disreputable contact with TB patients and duration of engagement as the main risk factors for job-related TB infection in HCWs. These studies emphasize the threat of acquired *M. tuberculosis* contagion and the imperative need for a preventive intervention in public health [7].

### 5. Latent tuberculosis infection in HCW

Latent tuberculosis has long been seen as a significant hazard for HCWs and more prone to latent TB infections which are never exposed to TB patients. The risk is low for fewer than ten TB admission annually per 100 HCWs (less than 0.2 percent), and high (between 1.7 and 3.9

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