

Original research article

Study of Prevalence of TB Infection Among Health Care Workers in Tertiary Care Centre

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Abstract

Background: Tuberculosis (TB) is an air borne communicable disease caused by bacteria named *Mycobacterium tuberculosis* that is spread through the air from person to person. The TB bacteria are expelled in the air when a person with TB disease coughs, sneezes, speaks, or sings. People nearby may breathe in these bacteria and become infected. In most people who breathe in TB bacteria and become infected, the body is able to fight the bacteria to stop them from growing. If TB bacteria become active in the body and multiply, the person will progress from latent to active TB disease. Infection is most likely to occur when an individual is exposed to someone with TB disease on a day-to-day basis, such as by living or working in close quarters with someone who has the active disease.

Methodology: The descriptive longitudinal study was conducted among 600 HCWs at Jawahar Lal Nehru medical college and Hospital, Bhagalpur. (oct 2018 to feb -2020). The data was collected by administering TB screening questionnaire (Annexure 2). Separate written informed consent was obtained for performing the tuberculin skin test (TST). Following this each study participant was administered the TST. Each subject was reviewed between 48 hours to 72 hours of the TST to read the reaction. All the subjects who gave negative TST reaction were followed up after one year.

Conclusion: Prevalence of latent TB infection was 20.1% and it was significantly associated with age, place of residence, education, work commute time and mode of transport. Incidence of latent TB infection was 19.4% and it was significantly associated with gender, place of residence education, work commute time and marital status. Study subjects working in laundry department, especially those who came in contact with patients while collecting linens, housekeeping workers and pharmacy workers who dispense drugs at the counter were at higher risk of developing TB infection.

Keywords: TB infection, Tuberculosis, Tuberculin Skin Test, health careworkers.

Introduction

Tuberculosis (TB) is an air borne communicable disease caused by bacteria named *Mycobacterium tuberculosis* that are spread through the air from person to person. The TB bacteria are expelled in the air when a person with TB disease coughs, sneezes, speaks, or sings. People nearby may breathe in these bacteria and become infected. There are two types

of TB conditions: latent TB infection and TB disease. Tuberculosis bacilli may remain dormant in the infected host without any symptom manifestations; this is called latent TB infection. In most people who breathe in TB bacteria and become infected, the body is able to fight the bacteria to stop them from growing. People with latent TB infection do not feel sick, do not have any symptoms, and cannot spread TB bacteria to others. If TB bacteria become active in the body and multiply, the person will progress from latent to active TB disease. People with TB disease usually have symptoms and may spread TB bacteria to others. If not treated properly, TB disease can be fatal. Two billion people, equal to one third of the world's total population are infected with TB bacilli. One in ten people infected with TB bacilli will become sick with active TB. TB is a worldwide pandemic, though the highest rates per capita (a quarter of all TB cases) are in Africa and Asian countries. TB is a leading killer among young women, especially in Africa. If left unchecked within 20 years TB will kill a further 35 million people. In 2015, there were an estimated 10.4 million new (incident) TB cases worldwide. There were an estimated 4,80,000 new cases of multidrug-resistant TB (MDR-TB) and an additional 1,00,000 people with rifampicin-resistant TB (RR-TB) who were also newly eligible for MDR-TB treatment. There were an estimated 1.4 million TB deaths and an additional 0.4 million deaths resulting from TB disease among people living with HIV. Infection is most likely to occur when an individual is exposed to someone with TB disease on a day-to-day basis, such as by living or working in close quarters with someone who has the active disease. Even then, because the bacteria generally stay latent (inactive) after they invade the body, only a small number of people infected with TB will ever have the active disease. It is suggested that "because these latent infections can eventually become active, even people without symptoms should receive medical treatment. Medication helps to get rid of the inactive bacteria before they become active". Transmission of TB in health care settings to both patients and HCWs has been reported from virtually every country of the world, regardless of local TB incidence. TB transmission occurs when droplet nuclei aerosolized by patients with infectious pulmonary TB are inhaled by other persons. Transmission is most likely to occur from unrecognized or inappropriately treated TB. The risk for transmission varies by setting, occupational group, local prevalence of TB disease, patient population, and effectiveness of TB infection control measures. The risk of transmission of *Mycobacterium tuberculosis* from individuals with TB to other HCWs has been recognized for many years. This risk is greater when large numbers of infectious (smear-positive) TB patients are managed at a health-care facility, and can be reduced with the implementation of effective infection-control measures.

Objectives

To estimate the incidence of tuberculosis infection among health care workers in a tertiary care centre.

Review of Literature

Globally in the year 2015, there were an estimated ten million incident cases of Tuberculosis, which is equivalent to 142 cases per 1,00,000 population. The estimates of TB incidence have been revised upwards for the period 2000–2015, compared with those published in the 2015 global TB report. Most of the estimated number of cases in 2015 occurred in Asia (61%) and the WHO African Region (26%); a smaller proportion of cases occurred in the Eastern Mediterranean Region (7%), the European Region (3%) and the Region of the Americas (3%). The 30 high TB burden countries accounted for 87% of all estimated incident cases worldwide. The six countries that stood out as having the largest number of incident cases in 2015 were (in descending order) India, Indonesia, China, Nigeria, Pakistan and South Africa (combined, 60% of the global total). Of these, India, Indonesia and China alone accounted for 45% of the global cases in 2015. The annual number of incident TB cases varied widely among countries in 2015,

from under 10 per 1,00,000 population in most high-income countries to 150–300 in most of the 30 high TB burden countries. India accounts for one fourth of the global TB burden. In 2015, an estimated 28 lakh cases of tuberculosis was diagnosed and 4.8 lakh people died due to TB. An estimated 1.3 lakh incident multi-drug resistant TB patients emerge annually in India which includes 79,000 MDR-TB cases among notified pulmonary cases. India bears second highest number of estimated HIV associated TB in the world. An estimated 1.1 lakh HIV associated TB cases were reported in 2015 and an estimated 37,000 patients died among them. TB treatment coverage was 59% in the year 2015 in India. In another retrospective study conducted by Gopinath et al with the objective of documenting the incidence of tuberculosis among HCWs in the Christian Medical College (CMC), Vellore, India, it was found that 125 cases of tuberculosis occurred over a period of 10 years and the overall incidence of sputum positive cases was similar to that observed in the general population. It also found that the chance of developing extra-pulmonary tuberculosis was higher in HCWs compared with the general population. A longitudinal study was conducted in Inner Mongolia Autonomous Region by Guangxue He et al, with the objective of measuring the prevalence and incidence of LTBI among village doctors, found that 19.5% of the 880 participating village doctors had a positive TST and 46.0% had a positive QFT-GIT result. Factors associated with TST prevalence was BCG scar and smoking. Risk factors associated with QFT-GIT prevalence included being male, lack of college education and working for >25 years as a village doctor. The annual incidence of LTBI was 11.4% by TST and 19.1% by QFT-GIT. QFT-GIT conversion, found that the prevalence and incidence of LTBI among village doctors was high. The study also found that several work-related risk factors such as working location and duration, and also the length of exposure to potentially infected patients were significant risk factors. In a prospective study by Park et al, with the objective of evaluating the conversion and reversion rates of monthly IGRAs for 1 year among HCWs in contact with patients with TB in South Korea, a country with an intermediate TB burden, it was found that fluctuation in IGRA was common among HCWs in contact with patients with TB when tested monthly. This could be understood as a result of poor reproducibility of the assay, repeated infection.

Material and methods

The descriptive longitudinal study was conducted among 600 HCWs at Jawahar Lal Nehru medical college and Hospital, Bhagalpur. (oct 2018 to feb -2020). The data was collected by administering TB screening questionnaire (Annexure 2). Separate written informed consent was obtained for performing the tuberculin skin test (TST). Following this each study participant was administered the TST. Each subject was reviewed between 48 hours to 72 hours of the TST to read the reaction. All the subjects who gave negative TST reaction were followed up after one year. The hospital offers speciality and super-speciality services at outpatient and inpatient departments. The hospital has 33 outpatient departments, in which, around 2400 outpatient visits and 150 admissions occur every day. The hospital has bed strength of about 1350 with average daily bed occupancy of approximately 85%. A total of about 3000 employees work in this hospital including, doctors, nurses, nursing aides, laboratory technicians, housekeeping staff and others. From previous studies, prevalence of LTBI among HCWs was, on an average, 54% (range 33% to 79%). Annual risk of LTBI among HCWs was 12%. All HCWs were stratified according to their work profile as doctors, nurses, lab technicians, nursing aids, pharmacist, laundry workers (only those who come in contact with patients), dietary workers (only those who come in contact with patients) and workers from housekeeping department. The required sample was randomly selected from each group except doctors. Due to a high non-response rate among the doctors, all doctors who agreed for the TST were interviewed and subsequently tested either once or twice depending on their reactivity.

Inclusion Criteria

All HCWs at Jawahar Lal Nehru medical college and Hospital Bhagalpur, which included Doctors, Nurses, Laboratory technicians

Exclusion criteria

HCWs giving positive TST, HCWs who had TB in the past.

Health care workers are all people whose main activities are aimed at enhancing health. They include the people, who provide health services such as doctors, nurses, pharmacists, laboratory technicians, management and support workers.

Results

The study subjects consisted of 600 health care workers.

Socio demographic details of study subjects is as described below

Age and gender wise distribution of the study subjects

Age and gender wise distribution of the study subjects (n=600)

Age in years	Gender n (%)		Totaln (%)
	Male	Female	
<20	6 (25)	18 (75)	24 (4)
21-40	128 (23.8)	410 (76.2)	538 (89.7)
41-60	9 (23.7)	29 (76.3)	38 (6.3)
Total	143 (23.8)	457 (76.2)	600 (100)

Figures in parenthesis indicate row percentages except in the last column which indicates the column percentages) Mean = 27.8 years, SD = 7.1 years, Range = 18-57 years Majority of the study subjects (89.7%), were in the age group of 21-40 years followed by 6.3% of the study subjects who were in the age group of 41-60 years. Of those studied, 76.2% were females and 23.8% were males. It can be seen from the table that females outnumbered males across all the age groups mentioned.

Distribution of the study subjects based on their Religion

Religion of the subjects (n=600)

Religion	Frequency	Percentage
Hindu	186	31.0
Muslim	10	1.7
Christian	387	64.5
Others	17	2.8
Total	600	100.*

percentage is rounded off to the nearest whole number

Majority of study subjects were Christian 387 (64.5%). Followed by Hindus who totalled 186 (31%).

Current place of residence of the study subjects

Current place of residence (n=600)

Residence	Frequency	Percentage
Home	247	41.2
Hostel	353	58.8
Total	600	100.

58.8% of study subjects stayed in the hostel (provided by the hospital management). Majority of study subjects (392 65.3%) belong to upper class. 7.3% of study subjects belong to upper middle class and 10.7% belong to middle class. 5 subjects did not state their SES. Among those who had contact with TB patients, 28 (7.5%) had contact at home, 335 (90.1%) had contact at hospital and 9 (2.4%) had at both places among those who were taking medication for chronic ailments, the common ailments were hypothyroidism (12, 34%), hypertension (4, 11.4%), diabetes mellitus (7, 20%), both diabetes mellitus and hypertension (1, 2.9%) and others (11, 31.4%). Majority of the study subjects (501, 83.5%) reported receiving BCG vaccine. However only 478, 71.3% had BCG scar. Majority of the study subjects (372, 62%), reported having come in contact with TB patients 35, 5.8% of the study subjects were taking medication for chronic ailments 59, 9.8% of the study subjects had reported taking fluoroquinolone tablets. Among the subjects none of them had taken medication for TB, no injection drug abuse, no immunocompromised state. No subject had chronic kidney disease, no one was suffering from disease affecting food absorption and no one underwent gastrectomy or bypass surgery. Multivariate linear regression was performed taking incidence of TB infection as the dependant variable and all other factors found to be statistically significant in univariate analysis as independent variable. No single variable was found to be significant.

Discussion

This was a longitudinal descriptive study done among 600 HCWs in a private tertiary care centre. Majority of the study subjects belonged to the age group of 21 to 40 years. There were more subjects in the younger age group because the study was conducted in a teaching institute, majority of the students pursuing education in this institution (and its attached hospital) join back the hospital as employees after the completion of their studies. A sizeable number of the study subjects were post-graduates and nurses who were between 21-40 years of age. Nursing is still largely considered as a female dominated profession and only female nurses are recruited in this hospital hence this study had more females. Majority of the study subjects were unmarried. This study mainly consisted of the younger population who were not yet married and many of the post graduate doctors and nurses were unmarried. This hospital belongs to a religious-minority institution and hence majority of the employees belonged to Christian denomination. Majority of the health care workers stayed in the hostel provided by the institution. Majority of the study subjects had worked 10 years or less in this hospital. Employees of this hospital are from different states of Southern India, who after few years tend to migrate back to their native states or even migrate abroad. Nearly 50% of the study subjects earned a monthly income between 10,001 to 20,000 rupees. Few subjects (21.3%) received monthly income less than 10,000 rupees and many of these subjects worked in laundry, housekeeping, dietary and nursing aide departments. Majority of the study subjects (517, 86.3%) worked for a duration of less than 8 hours per day. This observation is true for personnel of all work profile(s). Few study subjects worked for more than 8 hours per day and most of these subjects were post-graduate doctors. This observation is as expected as post graduates are trained by giving exposure and much of their training happens as a hands-on experience in the hospital. Majority of the study subjects (501, 83.5%) reported having received BCG

vaccine. However only 478, (71.3%) had a BCG scar. In a study conducted by Sara S et al, in Sangli, Maharashtra among infants, with the objective of determining the scar failure rate and tuberculin conversion in term-infants vaccinated with BCG within the first month, it was found that less than 10% of infants failed to develop a scar following BCG vaccination. In another prospective study conducted in India by Anand et al in Tamilnadu among 206 HCWs with the objective of screening of health care workers for LTBI in a tertiary care hospital it was found that 36.6% were infected with TB using a TST induration ≥ 10 mm as a cut-off point. This study also had higher TST positive subjects compared to our study.

In a retrospective study was conducted by Gopinath et al with the objective of documenting the incidence of TB among HCWs in the Christian Medical College (CMC), Vellore, India over a 10-year period, it was found that the incidence of sputum-positive tuberculosis ranged from 0.37 to 1.57 per 1000 staff in different years. This was similar to that observed in the general population. It also found that the chance of developing extra-pulmonary tuberculosis. There was a significant association between work profile and TST 2 positivity (Table 24). There was a greater conversion among those study subjects working in the housekeeping, nursing and laundry departments.

Conclusion

Tuberculosis infection is most likely to occur when an individual is exposed to someone with TB disease on a day-to-day basis, such as by living or working in close quarters with someone who has the active disease. Transmission of TB in health care settings to both patients and HCWs has been reported from virtually every country of the world, regardless of local TB incidence.

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