

Risk factors for tuberculosis among health care workers in South India: a nested case–control study

Anoop Mathew^{a,*}, Thambu David^{a,b}, Kurien Thomas^{a,b}, P.J. Kuruvilla^c, V. Balaji^d,
Mary V. Jesudason^d, Prasanna Samuel^e

^aDepartment of Medicine, Christian Medical College Hospital, Ida Scudder Road, Vellore 632004, Tamil Nadu, India

^bClinical Epidemiology Unit, Christian Medical College Hospital, Ida Scudder Road, Vellore 632004, Tamil Nadu, India

^cStaff Students Health Services, Christian Medical College Hospital, Ida Scudder Road, Vellore 632004, Tamil Nadu, India

^dDepartment of Microbiology, Christian Medical College Hospital, Ida Scudder Road, Vellore 632004, Tamil Nadu, India

^eDepartment of Biostatistics, Christian Medical College Hospital, Ida Scudder Road, Vellore 632004, Tamil Nadu, India

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Abstract

Objective: The epidemiology of tuberculosis (TB) among health care workers (HCWs) in India remains under-researched. This study is a nested case–control design assessing the risk factors for acquiring TB among HCWs in India.

Study Design and Settings: It is a nested case–control study conducted at a tertiary teaching hospital in India. Cases ($n = 101$) were HCWs with active TB. Controls ($n = 101$) were HCWs who did not have TB, randomly selected from the 6,003 subjects employed at the facility. Cases and controls were compared with respect to clinical and demographic variables.

Results: The cases and controls were of similar age. Logistic regression analysis showed that body mass index (BMI) $< 19 \text{ kg/m}^2$ (odds ratio [OR]: 2.96, 95% confidence interval [CI]: 1.49–5.87), having frequent contact with patients (OR: 2.83, 95% CI: 1.47–5.45) and being employed in medical wards (OR: 12.37, 95% CI: 1.38–110.17) or microbiology laboratories (OR: 5.65, 95% CI: 1.74–18.36) were independently associated with increased risk of acquiring TB.

Conclusion: HCWs with frequent patient contact and those with BMI $< 19 \text{ kg/m}^2$ were at high risk of acquiring active TB. Nosocomial transmission of TB was pronounced in locations, such as medical wards and microbiology laboratories. Surveillance of high-risk HCWs and appropriate infrastructure modifications may be important to prevent interpersonal TB transmission in health care facilities. © 2013 Elsevier Inc. All rights reserved.

Keywords: Tuberculosis; Health care workers; Infectious disease transmission, patient-to-professional; Risk factors; Nested case–control study; Low body mass index; Nosocomial tuberculosis transmission

1. Introduction

TB continues to be an important public health problem in India, with an annual two million new cases of TB from India accounting for a fifth of the new TB cases occurring globally [1]. Two of every five Indians are infected with the TB bacillus [2]. With an increase in the number of people living with HIV and AIDS in India, the incidence of HIV/TB coinfection is expected to be on the rise. The high incidence of multidrug-resistant TB (MDR TB) in India is yet another issue that poses a challenge to infection control measures [3,4].

The Revised National TB Control Program (RNTCP) in India has been successful in providing access to Directly

Observed Treatment Short Course (DOTS) for the whole population [2]. However, control of nosocomial transmission of TB is still neglected in Indian hospitals [5]. Delay in the diagnosis and treatment of TB in hospitalized patients [6,7], underutilization of rapid diagnostic techniques, failure to isolate infectious TB cases routinely, unrecognized drug resistance among the mycobacterial strains, lack of recommended engineering and environmental standards [8–10], large number of TB patients being handled in crowded and poorly ventilated wards [11] and waiting rooms, lack of recommended personal protection equipment [12], financial and logistic constraints in implementing infection control measures, and absence of national guidelines for screening and treatment of latent TB infection (LTBI) among health care workers (HCWs) all contribute to high rates of nosocomial TB, particularly among HCWs. Poor knowledge and attitude, with perceived lack

* Corresponding author. Tel.: +91-9894408806; fax: +91-4162232035.

E-mail address: anoopmatts@gmail.com (A. Mathew).

What is new?

Key findings:

- Health care workers (HCWs) with frequent direct patient contact were at high risk of acquiring tuberculosis (TB).
- Nosocomial transmission of TB may be pronounced in locations, such as medical wards and microbiology laboratories.
- The risk was higher for HCWs with BMI < 19 kg/m².
- In this study, we have documented a modestly increased rate of active TB (314 per 100,000 HCWs) and a markedly increased rate of extrapulmonary TB (EPTB; 148 per 100,000 HCWs) among HCWs at a tertiary care center in India.

What this adds to what is known?

- To the best of our knowledge, low body mass index has not been earlier shown to be an independent risk factor for acquiring TB.
- Our institutional data clearly show that the EPTB rates are much higher in HCWs as compared with the general population

What is the implication, what should be changed now?

- Surveillance of high-risk HCWs and appropriate infrastructure modifications should be implemented to prevent interpersonal TB transmission in health care facilities.

of vulnerability to TB among HCWs [13] and poor compliance with routine screening for TB among HCWs [14] need to be addressed. Infection control practices recommended by international agencies [8,9,12] have limited practical feasibility in most of the health care centers in India because they are not cost-effective. The World Health Organization (WHO) guidelines for hospitals in resource-limited settings [15] have also not been strictly adhered to.

Few studies, including one from our institution, have reported a high incidence of active TB among HCWs in India [13,16]. However, these observational studies have had many limitations. Lack of controls have particularly limited their validity. Interpersonal transmission of TB is of concern in hospitals in India [17]. In low- and middle-income countries, the median prevalence of LTBI was 63% (range: 33–79% across studies), with one Indian study reporting 50% prevalence in 2005 [18]. The very-high prevalence of LTBI coupled with concerns about emergence of drug-resistant TB strains have led to controversy over the feasibility of treating LTBI in such settings. Even in

2010, LTBI prevalence rates as high as 50.2% continue to be reported from India [19]. Hence, a strategy of identification of hotspots of interpersonal TB transmission in the health care setting may lead to implementation of cost-effective infrastructure modifications to contain such transmission. The surveillance of high-risk subpopulations among HCWs is vital to achieve early diagnosis of active TB and rapid initiation of effective anti-TB drugs. Hence, data collected from 2003–2004 was critically analyzed to identify potential risk factors for transmission of disease so that cost-effective interventions may be initiated to reduce the nosocomial spread of TB. The present study is a nested case–control design assessing the risk factors for acquiring active TB among HCWs in a tertiary teaching hospital in India.

2. Methods

2.1. Setting

The study was conducted at the Christian Medical College Hospital (CMCH), Vellore between March 2003 and December 2004 using a nested case–control design by enrolling cases and controls from an established larger cohort of HCWs. Subjects who developed TB were recruited as cases and the control group was sampled from unaffected members of the cohort. Covariate information was collected only for established cases and sampled controls. Certain exposure data were available for the whole cohort of HCWs, thereby limiting the recall bias. CMCH is a 2,100-bedded tertiary care referral hospital located at Tamil Nadu, South India with a cohort of more than 6,000 HCWs who have long-time employment in the institution. All HCWs are offered preventive and curative health care services through the Staff Students Health Services. Medical records of all services are maintained at the medical records department.

All employees are given a thorough medical examination, including investigations and chest X-rays. Those with active TB are not selected for employment till completion of anti-TB therapy. Thereafter, all employees undergo a voluntary annual or biannual medical examination that includes history and physical examination, blood tests, and imaging as deemed appropriate by the physician-in-charge. All these details are recorded in the employees' medical chart in a standardized format; the chart is retained in the hospital medical records division permanently. The hospital has implemented RNTCP standard procedures for recording its employees diagnosed with TB since the start of the cohort in 1994.

CMCH has more than 1,300 TB hospitalizations each year. DOTS is provided by the hospital through the RNTCP. TB patients requiring admission are provided initial inpatient care in all the medical wards and if found to be sputum smear positive, they are subsequently shifted to the isolation ward, where known MDR TB cases are also admitted.

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