Brief Report

Prevalence of tuberculosis among health care workers in tuberculosis specialized hospitals in China

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Abstract: Objectives: Tuberculosis (TB) specialized hospitals are playing an increasingly important role in the diagnosis and treatment of patients with TB in China. This study aimed to investigate the prevalence of TB among health care workers (HCWs) in TB specialized hospitals in China. Methods: We conducted a cross-sectional survey to collect longitudinal information on the number of HCWs and patients with TB from HCWs among 203 TB hospitals in China. Results: Overall, these 186 TB cases accounted for the incidence of 985 per 100,000 population. The prevalence ratios among medical professionals (PR = 2.40) and laboratory technicians (PR = 2.17) were significantly higher than other hospital staff (PR = 1.04). In addition, general hospitals with TB clinics had the highest prevalence ratio of TB (PR = 5.15), while designated TB hospitals had the lowest prevalence ratio (PR = 1.48). Conclusion: Our findings demonstrated that HCWs are suffering from an increased risk of infection with TB in China, and medical professionals (physicians and nurses) and general hospitals with TB clinics have the highest prevalence ratio of TB.

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Key words: Health care workers, Nosocomial infection, Tuberculosis

Introduction

Tuberculosis (TB) is the second deadliest infectious disease worldwide as of 20141 and represents a major public health problem. According to the estimation of World Health Organization (WHO), China has the third highest TB burden, with 930,000 incident TB cases and 38,000 deaths due to TB in 2014. In addition, China has a serious epidemic of drug-resistant TB (DR-TB), especially multi-drug resistant TB (MDR-TB)2. According to the latest national survey, 5.7% of new TB cases and 26% of retreated cases in the public health system were MDR-TB2. This far surpasses the global average where approximately 3.5% of new cases and 20.5% of the retreated cases are MDR2.

Ahead of the early 2000s, the diagnosis and management of patients with TB were majorly organized through the public health system in China. However, management of TB care in the public health system has proven to be a challenging task. The majority of patients seek care in the hospital system, which operates outside the control of National Center for TB Control and Prevention (NCTB)3. Furthermore, there are few qualified medical professionals in the public health system than in the hospital system due to unsatisfying compensation4. On recognizing these challenges, the Chinese Ministry of Health released a guideline in early 2000, which was intended to streamline TB services and move TB care toward hospital-based management5. At the center of the hospital-based approach, there are TB specialized hospitals where the clinical management of TB is provided5. Owing to the policy, TB specialized hospitals are playing an increasingly important role in the diagnosis and treatment of patients with TB in China. However, there is generally a lack of knowledge with regard to the occupational risk of health care workers (HCWs) providing service in TB specialized
hospitals. Therefore, in this study, we aim to investigate the prevalence of TB among HCWs from different types of TB hospitals in China by reporting data from a national survey.

Methods

Setting and data collection

The study was conducted in 2010 in 31 provinces, municipalities, and autonomous regions, as well as Xinjiang Production and Construction Corps of China. All TB specialized hospitals in China in 2009 with at least 30 beds in TB wards were enrolled in this study. The cross-sectional information was obtained using questionnaires designed by the National TB Clinical Center. Longitudinal information on the number of HCWs and patients with TB from HCWs was covered by the questionnaire.

In total, 203 questionnaires were distributed—one per each TB specialized hospital—. The questionnaires were filled out by the directors of department, physicians, nurses, and laboratory technicians. The questionnaires were self-administered; therefore, to ensure informed reporting, all participants attended a training course held by the National TB Clinical Center prior to filling out the survey. The provincial Bureau of Health participated in the collection of questionnaires from each province to ensure obtainment of all the distributed questionnaires. In addition, 20% of the questionnaires were verified using the original hospital records obtained from the provincial bureau of health. Any discrepancies were resolved through telephone interviews.

Definitions

TB specialized hospitals are hospitals and health facilities that are designated by local authority to conduct the diagnosis and treatment of TB. Based on the situation of different regions in China, the existing hospitals with clinics providing TB clinical care in the counties and prefectures were designated as TB specialized hospitals, while for the regions without these hospitals, the local authority would set up a clinic in a general hospital to provide TB clinical care for local patients. Hence, TB specialized hospitals consisted of pulmonary hospitals, chest hospitals, infectious disease hospitals, designated TB hospitals, general hospitals with TB departments, chronic disease hospitals with TB departments, and TB dispensaries.

The diagnosis of TB cases followed the criteria recommended by the National TB Programme of China, including confirmed TB cases and clinically diagnosed TB cases. Confirmed TB cases were defined as TB suspects with positive laboratory evidence, while the diagnosis of clinically diagnosed TB cases mainly relied on clinical presentations, radiographic examination, and empirical TB treatment.

Geographical regions were defined on the basis of the Chinese administrative division; the Eastern region of China includes 12 provinces: Liaoning, Hebei, Beijing, Tianjin, Shandong, Jiangsu, Zhejiang, Shanghai, Fujian, Guangdong, Guangxi, and Hainan; the Central region of China includes 9 provinces: Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Hubei, Jiangxi, Anhui, and Hunan; the Western region of China includes 10 provinces: Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Sichuan, Chongqing, Yunnan, Guizhou, and Tibet.

Data analysis

To maintain high data integrity, all information was double-entered using Epi-Info software (Atlanta, GA). SPSS 15.0 was used for all analyses. Chi-square test was used to compare the prevalence of TB cases among different groups.

Ethical approval

This study was approved by the Ethics Committee of Beijing Chest Hospital, affiliated with Capital Medical University. Informed consents were obtained from all study participants.

Results

A total of 186 TB cases were identified among the staff in designated TB hospitals in 2009 (Table 1). These included 157 cases (84.4%) from medical professionals (physicians and nurses), 13 cases (7.0%) from laboratory technicians, and 16 cases (8.6%) from other hospital staff, such as hospital administration staff, logisticians, and IT personnel. Overall, these 186 TB cases accounted for the incidence of 985 per 100,000 population. The prevalence ratio (PR) of TB among HCWs in the 203 hospitals as compared with the prevalence of all forms of TB among the general population in China in 2009 was 2.15. The prevalence ratios among medical professionals (PR = 2.40) and laboratory technicians (PR = 2.17) were significantly higher than other hospital staff (PR = 1.04; P = 0.001 for medical professionals and P = 0.042 for laboratory technicians), while there was no statistical difference between medical professionals and laboratory technicians (P = 0.725).

Nosocomial transmission of TB among HCWs also varies by geographic region. According to Table 1, as compared with the Central and Western regions, the prevalence ratio of TB in TB specialized hospitals was the highest in the Eastern regions (PR = 2.42). With regard to the types of hospitals, general hospitals with TB clinics have the highest prevalence ratio of TB (PR = 5.15), while designated TB hospitals have the lowest prevalence ratio of TB (PR = 1.48).
transmission control measures can reduce the risk of TB infection. HCWs from TB specialized or infectious disease hospitals always receive a formal two-day training with regard to TB infection control, such as the use of personal protective equipment, while those from general hospitals are less likely to receiving this training. Hence, HCWs from TB specialized or infectious disease hospitals prefer to adopt suitable measures to prevent nosocomialTB infection, thereby resulting in the relative low prevalence of TB in this population. On the other hand, TB departments in general hospitals are always modified from general wards, and environmental control measures in these wards are less satisfactory than those from TB specialized hospitals with negative pressure or well-designed natural ventilation. Inadequate measures in the wards of general hospitals increase the exposure of clinical staff to TB, thereby resulting in the higher prevalence of TB in this population. Another interesting finding of this study was the regional differences in the prevalence of TB. As compared with the Central and Western regions, the prevalence ratio of TB in TB specialized hospitals was the highest in the Eastern regions, which may be due to the relative high proportion of general hospitals among TB specialized hospitals in the Eastern regions.

Nevertheless, the high incidence of TB among HCWs contributes to the inadequate TB infection control in China. In 2009, a guideline from China’s Ministry of Health recommended the use of a respirator, cap, and gloves by HCWs for specific TB infection control measures. However, as the most important protective approach, no specific standards, including the types and usage time, have been defined for the respirator used in TB

Table 1. Nosocomial transmission of tuberculosis in the 203 tuberculosis specialized hospitals in China in 2009

| Classification                        | Total no. HCWs | Tuberculosis cases among HCWs | Prevalence of tuberculosis among HCWs | Prevalence ratio |
|---------------------------------------|----------------|-----------------------------|-------------------------------------|-----------------|
| Occupations                           |                |                             |                                     |                 |
| Medical Professionals                 | 14,234         | 157                         | 1,103                               | 2.40            |
| Lab Technicians                       | 1,304          | 13                          | 997                                 | 2.17            |
| Others                                | 3,361          | 16                          | 476                                 | 1.04            |
| Regions                               |                |                             |                                     |                 |
| Central                               | 8,327          | 76                          | 913                                 | 1.99            |
| Eastern                               | 7,208          | 80                          | 1,110                               | 2.42            |
| Western                               | 3,364          | 30                          | 892                                 | 1.94            |
| Types of hospitals                    |                |                             |                                     |                 |
| General hospital with a TB department | 2,583          | 61                          | 2,362                               | 5.15            |
| Infectious diseases hospital          | 4,337          | 37                          | 853                                 | 1.86            |
| Designated TB hospital                | 11,299         | 77                          | 681                                 | 1.48            |
| Others                                | 680            | 11                          | 1,618                               | 3.53            |
| Total                                 | 18,899         | 186                         | 985                                 | 2.15            |

HCWs: health care workers. TB: tuberculosis.

All figures represent incidence of tuberculosis per 100,000 HCWs.

Prevalence ratio was calculated using the prevalence of all forms of tuberculosis in general population in China in 2009/1.459 per 100,000 population.

Medical professionals include physicians and nurses.

Other staff includes administrative and logistic personals

Discussion

HCWs based in TB dispensaries face an increased risk of being infected with TB. This has been declared as an occupational hazard and calls for an improved policy to protect those who are on the front line of TB care. According to estimates from previous studies, 1% to 10% of HCWs may be annually infected in hospitals with more than 200 admissions per year for TB. Data from the national TB epidemiological survey conducted in 2000 has shown that the prevalence of TB is about 414 per 100,000 population. In this study, we found that the incidence of TB among HCWs in China was 985 per 100,000 population, which was higher than that in Thailand (188 per 100,000 population), Turkey (200 per 100,000 population), and Malaysia (280 per 100,000 population), while lower than that in South Africa (1180 per 100,000 population) and India (1260 per 100,000 population). Similar to previous studies, medical professionals (physicians and nurses) and laboratory technicians showed a higher risk than other groups, which may be due to the high-risk exposure for M. tuberculosis. In addition, nosocomial transmission of TB among HCWs was the highest in general hospitals with a TB department. Effective infection control measures can reduce the risk of M. tuberculosis transmission. On one hand, in view of the expectable risk of TB infection, HCWs from TB specialized or infectious disease hospitals always receive a formal two-day training with regard to TB infection control, such as the use of personal protective equipment, while those from general hospitals are less likely to receiving this training. Hence, HCWs from TB specialized or infectious disease hospitals prefer to adopt suitable measures to prevent nosocomial TB infection, thereby resulting in the relative low prevalence of TB in this population. On the other hand, TB departments in general hospitals are always modified from general wards, and environmental control measures in these wards are less satisfactory than those from TB specialized hospitals with negative pressure or well-designed natural ventilation. Inadequate measures in the wards of general hospitals increase the exposure of clinical staff to TB, thereby resulting in the higher prevalence of TB in this population. Another interesting finding of this study was the regional differences in the prevalence of TB. As compared with the Central and Western regions, the prevalence ratio of TB in TB specialized hospitals was the highest in the Eastern regions, which may be due to the relative high proportion of general hospitals among TB specialized hospitals in the Eastern regions.
infection control. The high incidence rate of TB diseases among HCWs highlights the urgent need to improve the approaches of infection control in TB hospitals to reduce the transmission from patients with TB to HCWs, especially for those from general hospitals.

There are some limitations in the study. First, in computing the prevalence ratio in different geographical regions, the national overall prevalence in 2009 was used. This is because there is no publically available data on the prevalence of TB (all forms) in different geographical regions in 2009. Second, employment of the person-year method is more preferable to describe the prevalence rates of patients with TB in HCWs, while this cross-sectional study did not collect information with regard to the incident TB cases during the follow-up period. Third, risk factors for acquiring TB among HCWs in China were not analyzed in our study.

Conclusions

As the first study to provide an overview on the prevalence of TB among HCWs from TB hospitals in China, our findings demonstrated that they are suffering from an increased risk of being infected with TB, and medical professionals (physicians and nurses) and general hospitals with TB clinics have the highest prevalence ratio of TB. In view of the high incidence rate of TB in hospitals, policymakers should focus on improving the approaches of infection control in TB hospitals, such as standardized training with regard to the use of personal protective equipment for new HCWs and mandatory application of N95 respirator masks, to reduce the transmission from patients with TB to HCWs.

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Conflicts of interest: The authors declare that there are no conflicts of interest.

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