

## CONCISE COMMUNICATION

## Hidden Reservoir: An Outbreak of Tuberculosis in Hospital Employees with No Patient Contact

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We describe an outbreak of tuberculosis (TB) in the food preparation area of a hospital, which demonstrates that employees in healthcare settings may serve as potential risks for spread of TB even if they have no direct patient contact.

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Despite a decline in tuberculosis (TB) in the United States, healthcare providers (HCPs) continue to face risks for exposure to TB that vary with geography and patient population.<sup>1,2</sup> The Centers for Disease Control and Prevention (CDC) recommends annual testing of HCPs “who have the potential for exposure to *M. tuberculosis* through air space shared with persons with TB disease.”<sup>3</sup> Here, we describe an outbreak of TB in the food preparation area of a hospital in which most employees did not have direct patient contact.

### METHODS

The site of investigation was the University of Virginia Medical Center, a 619-bed tertiary-care hospital with more than 33,000 patients who receive inpatient or ambulatory care annually and nearly 9,000 health providers and support staff. All medical center employees received a 2-step Mantoux tuberculin skin test (TST) upon hire, and employees with face-to-face contact with patients underwent annual tuberculosis skin testing thereafter. In August 2010, the occupational health department identified 4 nutrition services employees with TST conversions but no known exposures to a patient with active TB, compared to a baseline average of 0.23 conversions per month without known exposure.

All current nutrition services employees ( $n = 210$ ) and individuals whose employment had ended within the previous 6 months ( $n = 14$ ) underwent TST and were interviewed using a standard questionnaire for signs and symptoms of TB. Those who did not convert had a repeat TST 8–10 weeks after their initial test. Employees hired <2 months prior to the identification of the first conversion were retested 8–10 weeks after their potential last exposure. Individuals with previously positive TST tests were evaluated clinically.

TST conversion was defined based on CDC guidelines.<sup>3</sup> All TST converters and employees with a positive symptom assessment underwent chest radiography. Those with chest radiograph abnormalities underwent medical evaluation for active TB, and those with active TB were given treatment and underwent contact tracing. This study was reviewed and deemed exempt by the University of Virginia Medical Center Institutional Review Board.

TST conversion rates and univariate analysis were calculated using SAS version 9 (Cary, NC).

### RESULTS

The exposure workup included 224 current and former employees, and 12 former employees were lost to follow-up. The median age of those tested was 40.5 years (inner quartile range [IQR], 30–50 years), and the median duration of employment was 4 years (IQR, 1–10 years). Initial evaluation identified 20 employees (9.4%) with documented TST conversions.

In total, 3 employees with TST conversions reported signs and symptoms of active TB; 2 had radiographic abnormalities and acid-fast bacilli–positive sputa that grew *Mycobacterium tuberculosis*, consistent with active pulmonary TB. A third employee was considered to have culture-negative TB based on compatible radiographic changes (right hilar lymphadenopathy, infiltrate, and effusion) and lack of an alternative diagnosis. The earliest potential symptoms of active TB in a nutrition service worker were not absolutely clear but may have occurred as many as 4 months prior to the recognition of the outbreak.

Four years after the initial evaluation a fourth employee undergoing a work-up for potential lung cancer was found to have *M. tuberculosis*–positive sputa after no evidence of malignancy was found following thoracotomy. The employee had a negative TST during the investigation of the outbreak and negative TSTs annually thereafter. At the time of diagnosis, the employee was confirmed to have a negative TST as well as a negative interferon- $\gamma$  release assay with appropriate controls (QuantiFERON-TB Gold, Cellestic, Valencia, CA). No risks for TB exposure could be identified other than work in the medical center, nor were any factors identified to explain why the employee was selectively anergic to TB. TST evaluation of contacts of the fourth employee did not identify any additional employees or other contacts with active or latent TB infection.

An environmental investigation showed that the kitchen, located in a confined space in the basement of the medical center, had a separate air distribution system from the rest of the hospital, including a dedicated exhaust air system independent of the rest of the medical center air handling systems. Of the 21 cases, 19 were linked to the kitchen.

TABLE 1. Odds Ratios for Mantoux Tuberculin Skin Test (TST) Conversions Among Nutrition Services Workers by Job Classification<sup>a</sup>

Job Classification	No.	TST Conversions	Patient Contact	OR (95% CI)	P Value
Retail	41	2	Yes	...	...
Dietician	41	0			
Administration	37	2			
Tray delivery	33	5			
Production	24	9	No	4.0 (1.6–10.0)	.003
Food preparation	36	3			

NOTE. OR, odds ratio; CI, confidence interval.

<sup>a</sup>Includes a worker with active pulmonary tuberculosis whose TST did not convert.

Of the 4 employees with active pulmonary TB, all had negative 2-step TSTs upon hire 2–20 years earlier. Among these 4 employees, 3 had no direct patient contact and therefore, following hospital policy before 2010, had not undergone annual TST assessment. The fourth had some patient contact and had negative TSTs annually prior to the outbreak. The odds of TST conversion for employees without patient contact were 4.0 (1.6–10.0;  $P=.003$ ) compared to the odds for those with patient contact (Table 1).

The index case was determined by epidemiologic investigation confirmed by spoligotype and mycobacterium interspersed repetitive units (MIRU) pattern at the public health department. The *M. tuberculosis* strain identified was consistent with a North American lineage of *M. tuberculosis*. The index case was an employee with no patient contact but potential links to cases of TB in the community. Other than the index case, the public health department did not identify additional cases of latent or active TB linked to this cluster.

In response to these cases, it was decided that all employees who work in the medical center must undergo annual TST evaluation regardless of whether they have direct contact with patients.

## DISCUSSION

We describe an outbreak of TB in a group of hospital employees, among whom most had no direct contact with patients. In contrast, most outbreaks of healthcare-associated TB are attributed to patient-to-HCP or patient-to-patient transmission of TB, often in association with delays in diagnosis or lapses in infection control measures.<sup>4–6</sup> Overall, 90% of the conversions were linked to the food preparation kitchen, and the TST conversions were higher among workers who worked only in the kitchen. However, 43% of those with TST conversions interacted with and were potentially at risk to transmit TB to patients. These results also show that, although the closed space of the kitchen facilitated the airborne spread

of TB between employees, the dedicated air system may have helped prevent the spread of TB to patient care areas in the medical center.

Air recirculation has been revealed as an important influence of *M. tuberculosis* transmission in several microepidemics.<sup>7,8</sup> These events form the basis of the CDC guidelines for heating, ventilation, and air conditioning systems affecting patient care.<sup>3</sup> However, no guidance is provided for areas of a hospital not involved in direct patient care. The air handling system in the nutrition services area of the hospital included the supply of 100% outdoor air, which has been shown to dilute airborne infectious droplet nuclei, and a dedicated exhaust system, which ensured that ventilated air, did not recirculate in patient care areas.<sup>3</sup>

This outbreak demonstrates some challenges regarding the prevention of *M. tuberculosis* transmission in medical facilities. Whereas the CDC advocates targeting annual TST screening to healthcare workers with significant direct contact with patients, the healthcare system depends on a large employee group with minimal or no patient care exposure yet who could act as a potential reservoir for TB in a health facility. This potential reservoir could lead to a risk for transmission of TB to employees engaged in direct patient care. In this case, the enclosed space of the kitchen may have amplified transmission between employees. As a result, our institution has elected to perform annual TST testing on all employees regardless of job classification.

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