ly way of controlling TB spread within a hospital still resides in a high degree of suspicion by first-line physicians, who constitute the entrance to the system.

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Annie-Claude Labbé, MD
Karl Weiss, MD, FRCPC
Michel Laverdiere, MD, FRCPC
Louise Poirer, MD, FRCPC
Hôpital Maisonneuve-Rosemont
Montreal, Quebec, Canada

Tuberculosis Contact Tracing Among Healthcare Workers: Source-Case Selection, Method of Tracing, and Outcome of Follow-Up

To the Editor:

Nosocomial tuberculosis (TB) is known to occur, usually when infectious patients are not recognized and properly isolated.[1,2] To minimize transmission, most healthcare facilities implement TB prevention measures based on the Centers for Disease Control and Prevention guidelines.[3] Among these measures is conducting contact tracing in suspected or confirmed TB cases.[4] Therefore, most TB control programs include tracing of exposed healthcare workers (HCWs). The value of these measures has not been examined but is likely to depend on the prevalence of TB, source-case selection, engineering conditions that may influence ventilation, and tracking methods. We elected to study the approach to contact tracing in our hospital to assess the effectiveness of tracing and outcome of follow-up.

The study was conducted at a 607-bed tertiary-care referral center with 6 to 10 cases of TB per year. All TB contact tracing conducted between December 1993 and April 1995 was identified by examining the records of the Infection Control Department. All cases with positive acid-fast bacilli (AFB) smears or mycobacterial cultures were identified by reviewing microbiology files. The clinical and microbiological characteristics of source-cases and all patients who were positive by AFB smear or culture were characterized by reviewing their medical records. For each episode, the method of identifying and tracing exposed HCWs, the number of employees that were followed, and the results of follow-up were determined. Additionally, hospital and departmental tuberculin-test conversion rates during the study period were noted.

Contact tracing was considered when the attending physician and the Infection Control Department were notified of positive AFB smears or cultures. An infection control practitioner reviewed the case, identified those who were not placed in TB isolation, and consulted the attending physician to determine the likelihood of TB and whether a contact tracing was warranted. The medical records then were reviewed to define the areas where exposure to the source-case prior to implementing isolation was possible and identify potential exposees. Transmission to household contacts was not investigated and identifying intensely exposed HCWs was not attempted. Notification of exposure then was sent to the physicians involved in the patient's care; the physician of any hospital roommate of the source-case; supervisors of any identified exposed HCW; all departments with potential exposees who are difficult to account for, such as phlebotomists and radiology technicians; and the Occupational Health Department. Each department supervisor independently notified involved HCWs at risk and recommended a follow-up at the Occupational Health Department for proper investigation. Tuberculin skin tests were placed and read by a staff member of the Occupational Health Department or the employee's own physician, and the results were reported to the Occupational Health Department. A follow-up skin test usually was attempted in 12 weeks. Whenever the

smear or the preliminary culture was determined later to be mycobacteria other than TB (MOTT), a notice was sent to disregard the previous exposure warning.

Twenty-one contact tracings initiated during the study period were examined. The source-cases represented 12 (75%) of 16 patients with positive AFB smears, 7 (14.9%) of 47 patients with positive cultures, and 2 individuals with granulomas and AFB in lung tissues. All source cases had respiratory symptoms and abnormal chest radiographs. The final diagnosis was TB in 13 instances, MOTT in 5 instances, and unknown (culture negative) in 3 cases. The AFB smear was positive in 12 cases: 6 untreated TB patients, 2 TB cases on therapy, 3 patients with MOTT, and 1 individual with an uncertain diagnosis. The intensity of the AFB smear did not differentiate TB from non-TB cases. Clinical and radiological characteristics were comparable in cases with TB or MOTT. Potential exposure occurred because isolation was delayed in 13 instances (62%), discontinued early in 4 instances (19%), or not implemented in an additional 4 instances (19%). The average duration of traced exposure was 5.5 days (range, 1-18 days), for a total of 115 days. As it turned out, contact tracing was initiated in 6 potentially highly infectious TB cases (untreated smear- and culture-positive or cavitary disease), 10 cases with low risk for infectiousness (smear-negative noncavitary TB, 5; smear-positive, culture-negative TB on treatment, 2; smear-positive, culture-negative unknown diagnosis, 3); and 5 cases with MOTT; Table).

Four hundred seventeen HCWs reported to the Occupational Health Department in response to the exposure notification (an average of 18.7 HCWs per source case). Twenty-five of these individuals were known to have previously positive tuberculin tests; no further testing was done, as they were asymptomatic. No tuberculin-skin test conversion was noted among the remaining 392 tuberculin-negative subjects. During the study period, routine skin testing with a 75% compliance rate showed an annual hospitalwide conversion rate of 0.41% (12/2,928 employees). These converters were scattered among various departments without clustering, and none recalled a specific exposure.

Our findings show that, in spite

of the apparent selection of source cases, contact tracing frequently was initiated in cases with minimal infectiousness or with MOTT. Whether this approach is unique to our facility or more widely practiced is unknown. We believe that the benefit of contact tracing can be increased by improving the source-case selection and the method of carrying out the investigation. Regarding case selection, two elements may have an impact on the effectiveness of the investigation: the likelihood of TB and the extent of infectiousness. The clinical and radiological characteristics, unfortunately, are nonspecific.[5] A positive smear and preliminary culture results could not distinguish TB from infection with MOTT; gene probes were unavailable during this study period. Furthermore, the predictors of infectiousness (cavitary disease, positive smear, and forceful cough) are most valuable in confirmed TB. Therefore, we believe that, in facilities with a low-to-moderate rate of TB, contact tracing should be limited to confirmed infectious TB and highly suspected cases, especially where transmission to household contacts is documented. Then, intensely exposed subjects should be screened first. Once transmission is documented, the investigation can be extended to others with less

TABLE
RELATIVE RISK FOR TUBERCULOSIS EXPOSURE IN CONTACT TRACINGS

Risk of infection	Investigation (N=21)		Traced Days (N=115)	
	N (%)			
None*	5	(24)	36	(31)
Low†	10	(48)	56	(49)
Potentially high‡	6	(28)	23	(20)

* *Mycobacterium* other than tuberculosis.
† Smear-negative non-cavitary tuberculosis; smear-positive culture-negative tuberculosis on therapy; smear-positive culture-negative uncertain diagnosis.
‡ Untreated smear- and culture-positive for cavitary tuberculosis.

intense exposure. This strategy likely will improve the outcome of the investigational approach and free resources for better utilization. We caution that this proposed strategy may not be appropriate without compliance to regularly scheduled skin testing and may not be applicable to facilities having a higher prevalence of TB, suboptimal engineering conditions, or HCWs with risk factors for disease progression.

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Joseph Baran, Jr, MD
Hitpreet Sanghera, MD
Riad Khatib, MD
St John Hospital and Medical Center
Detroit, Michigan

Comparable Specificity of Commercial Tuberculin Reagents

Gina Pugliese, RN, MS
Martin S. Favero, PhD

Villarino and coinvestigators from the CDC conducted a double-blind trial to compare the reaction size and specificity of skin testing with Aplisol, Tubersol, and the standard purified protein derivative (PPD-S1). Between May 14, 1997, and October 28, 1997, 1,555 persons at low risk of latent TB infection in six US cities received four tuberculin skin reagents at sites assigned at random. These included simultaneous skin tests with

Aplisol, Tubersol, PPD-S1 and either a second PPD-S1 or PPD-S2 (a proposed new standard).

Reaction size at each injection site was measured by two investigators blinded to type of reagent. Aplisol produced slightly larger reactions than Tubersol, but this difference did not significantly change skin-test interpretation. The mean ± SD reaction sizes were 3.4±4.2 mm with Aplisol, 2.1±3.2 mm with Tubersol, and 2.5±3.6 mm with PPD-S1. Assuming that all participants were uninfected, and using a 10-mm cutoff, the specificities of the tests were

high: Aplisol, 98.2%; Tubersol, 99.2%; and PPD-S1, 98.9%. Significant variability was not detected in interobserver, host, and lot-to-lot reagent comparisons.

The researchers concluded that, using a cutoff of at least 10 mm, testing with three different PPD reagents resulted in similar numbers of uninfected persons being classified correctly.

FROM: Villarino ME, Burman W, Wang YC, Lundergan L, Catanzaro A, Bock N, et al. Comparable specificity of 2 commercial tuberculin reagents in persons at low risk for tuberculous infection. *JAMA* 1999;281:169-171.