TABLE
PURIFIED PROTEIN DERIVATIVE RESULTS: ADULT DAY-CARE CENTER

Age, y	No. In Day Care	No. Tested*	No. With Results	No. With Positive PPD	Gender	PPD Size, mm
>85	3	3	3	0	—	—
81-85	3	3	3	0	—	—
76-80	8	8	7	2	2 M	10, 15
71-75	8	6	6	2	M, F	20, 25
66-70	13	12	12	2	M, F	12, 22
60-65	9	9	9	3	M, 2 F	15, 20, 20
<60	6	6	5	1	F	15
Total	50	47	45	10	5 M, 5 F	

Abbreviations: F, female; M, male; PPD, purified protein derivative.
* Two contacts with prior positive PPD and one patient admitted to hospital were not tested.

positive tuberculin tests (range, 10 to 25 mm), with 8 having reactions ≥15 mm. This unexpectedly high reactor rate, coupled with the extent of induration, implied recent exposure to TB rather than remote infection. None of these persons had clinical or radiographic evidence of TB. There were no secondary cases of active TB identified. Eleven staff members and 15 drivers also were tested; none were found to be positive.

While there has been an overall decrease in total TB cases in the United States in recent years, certain subgroups have accounted for an increased percentage of reported cases. One such group is foreign-born US residents from countries where TB is endemic; another is the elderly. Senior citizens represent a major reservoir of tuberculous infection, many individuals having become infected with TB early in adulthood during the prechemotherapy era. In 1997, for example, 23.6% of all new TB cases were reported in persons over the age of 65.[1] Reactivation of dormant lesions accounts for approximately 95% of cases of TB in this group of individuals,[2] usually as pulmonary disease. However, acquisition of new infection clearly has been documented, particularly in residents of nursing homes and other institutions.

Laryngeal TB is known to exhibit high aerosol infectivity, often arising via bronchogenic extension from a primary pulmonary tuberculous lesion. The presence of both laryngeal and pulmonary lesions in the source case likely was a major factor in the high infectivity rate described in this report. Although the index patient did not manifest prominent cough, aerosolization of droplet nuclei probably was achieved through singing, which carries a similar risk of transmission.

Health department officials utilize the concept of concentric circles when undertaking a contact investigation. The central circle consists of individuals who had the closest and longest duration of contact with the source case. It is important to realize that the center circle is not limited to household members. Because TB is transmitted via the airborne route, individuals who live, work, or are in some way in contact with a source case through a common ventilation system for a prolonged period of time are considered "close contacts" and are at risk of acquiring infection. As such, a thorough contact investigation must include not only the index case's household but often the working and social environment as well.

Recently, the Centers for Disease Control and Prevention published comprehensive guidelines and recommendations to prevent the transmission of TB in healthcare facilities.[3,4] However, many of the elderly do not reside in such facilities, because they do not require a skilled level of care but rather a low level of supervision. The relatively recent creation of the adult day-care center provides families with the flexibility of having loved ones reside at home, yet have supervision while family members work during the day. Unlike child day-care centers, where much has been written about the spread of infectious diseases, little has been written or is available to address appropriate infection control issues in these new settings.

Although the risk of TB transmission in the elderly population living in closed environments such as nursing homes has been well described,[5] this outbreak is unique in that it occurred in an adult day-care center. These programs are a relatively recent phenomenon and lack standardized regulations, such as a requirement for baseline tuberculin skin testing. Despite individuals spending much of their day in these settings, adult day-care programs have not been subject to the same scrutiny or infection control measures as nursing homes. With the increasing popularity of congregate settings for senior citizens, testing and surveillance for communicable diseases such as TB become important issues that need to be addressed.

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Level of Suspicion of Pulmonary Tuberculosis Over a 4-Year Period in a Teaching Hospital

To the Editor:

The steady decline in the annual rate of tuberculosis (TB) in Canada ended in 1987. Since then, this rate has reached a plateau and varies between 6.9 and 7.4 cases per 100,000 persons per year. The increasing

number of acquired immunodeficiency syndrome cases and growing immigration from endemic countries are mainly responsible for this situation. Reports documenting outbreaks of nosocomial TB, some of them caused by multidrug-resistant strains, have raised the issue of inadequate utilization of isolation practices to control TB transmission.

To evaluate the efficiency of the TB control program in our own institution, we conducted a study to examine the rapidity with which persons with confirmed TB were identified and subsequently isolated.

All confirmed TB cases (culture-positive) in our institution from April 1992 to March 1996, whether hospitalized or seen on an outpatient basis, were included in the study. We focused mainly on respiratory TB, evaluating "suspicion" and "isolation delay." Suspicion was defined as the request of TB smear or culture by the initial treating physician. Isolation delay was the elapsed time between the patient's initial evaluation and the institution of appropriate respiratory isolation.

Seventy-four patients diagnosed with TB were treated in our institution during the study period. Fifty-seven patients had respiratory infections, and 17 had nonrespiratory infections, mostly bone infections or adenitis. The number of newly diagnosed cases increased from 14 in 1992 to 21 in 1996.

Among the patients with respiratory TB, 40 were hospitalized. Eight patients already diagnosed with TB at admission were excluded from our analysis. Of the remaining 32 inpatient cases of pulmonary TB, 20 (63%) were not suspected initially. The median delay of suspicion for these cases was 2 days (range, 0-40). For these patients, acid-fast bacilli (AFB) smears were positive for 9 (45%) of 20 cases (Table).

Six (38%) of the 16 patients with smear-positive respiratory TB were put into isolation immediately. For the remaining 10, the median delay was 3 days (range, 1-13). Although the infectiousness of smear-negative patients with respiratory TB is known to be considerably lower than for AFB-smear–positive cases,[1] the median delay before suspecting TB was 6 days for patients with AFB-smear–negative respiratory TB (Table).

Treatment was initiated immediately upon hospital arrival for 3 of the AFB-smear–positive patients, whereas it took 1 to 14 days for the 13 other patients (median, 3 days). Patients who were AFB-smear–negative were never treated at arrival; the elapsed time before treatment in this group ranged from 2 to 110 days (median, 14 days).

TABLE
SUSPICION DELAY DIFFERENCES BETWEEN SMEAR-NEGATIVE AND SMEAR-POSITIVE PATIENTS WITH RESPIRATORY TUBERCULOSIS

	Smear-Negative Cases	Smear-Positive Cases	Total
Initially suspected	5	7	12
Nonsuspected	11 (68.8%)	9 (56.3%)	20 (62.5%)
Total	16	16	32
Median delay of suspicion for nonsuspected cases (d)	6.0	1.0	2.0
Range (d)	1-40	1-5	1-40

With regard to potentially useful clinical markers at arrival, among those with unsuspected respiratory TB, 55% originated from an endemic area, 10% were human immunodeficiency virus (HIV)-positive, 80% had symptoms compatible with TB, and 100% had abnormal chest radiographs. Almost all of our unsuspected hospitalized patients with respiratory TB had at least two of the four listed clinical criteria. There were no significant differences between suspected and unsuspected cases in terms of clinical presentation.

TB transmission to healthcare workers or hospitalized patients is a very well documented problem with serious consequences.[1] In Canada, a minority of healthcare facilities have sufficient isolation rooms that meet the new updated national standards for TB.

Although all TB control measures are very important, our study evaluated the first and most crucial step in TB control, which is suspicion of the disease. Results in our institution showed that as much as 56% of AFB-smear–positive hospitalized respiratory TB patients were not suspected initially. During the study period, no secondary cases of TB were documented in our hospital. Nevertheless, the costs related to these investigations are always problematic for infection control personnel.

The level of suspicion is the easiest target for intervention. Our data suggest that education should target first-line practicing physicians in order to increase their suspicion threshold for TB, especially for certain categories of high-risk patients. In four retrospective studies, TB diagnosis was delayed in 40% to 50% of active infections.[2] Delayed diagnosis was an important contributing factor in 7 of 8 outbreaks due to a single index case.[2] In almost all reported situations of nosocomial transmission, undersuspicion of TB was a strong contributor to disease transmission.

It is known that some degree of overisolation should be tolerated in cases of suspected TB.[3] The major advantage may be a reduction in the number of TB exposures of patients and healthcare workers. Moreover, the high cost associated with all the control measures should urge every healthcare facility to implement a program for suspecting and rapidly isolating potential TB cases. In one large study, infection control measures consisting of administrative controls, such as mandatory isolation of all suspected TB cases and of all HIV patients with abnormal chest radiographs, seemed to be very effective.[4] These measures could be put in place very rapidly and at a fraction of the cost of the needed engineering modifications, which are nonetheless essential. The use of a simple algorithm using clinical criteria, chest radiograph, and sputum AFB smear may be used as an additional tool for isolating suspected pulmonary TB cases.[5] Although improvements to these algorithms are essential, they can be put in place at a low cost and still be very helpful. An educational program targeting emergency room physicians has been implemented in our institution with regard to TB.

The most efficient and least cost-

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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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