

By Gilbert Lowenthal, MD; Thomas Keys, MD

Tuberculosis Surveillance in Hospital Employees: Are We Doing Too Much?

Hospital workers in the past have been noted to be at increased risk of tuberculosis. For example, data from Great Britain in the 1950s showed that tuberculosis occurred three times more frequently in laboratory technicians, four times more frequently in pathologists, and ten times more frequently in diners than expected for the general population.¹ Even in the late-1960s in Ontario, Canada, the tuberculosis attack rate was twice as frequent in clinical staff than in clerical staff.² Tuberculosis was such a common disease in the pre- and early chemotherapeutic era that as high as 90% of older individuals skin tested in the 1960s were tuberculin-positive. Tuberculin skin tests were actually promoted during this time to find the minority of patients who were tuberculin-negative and, thus, who would be candidates for BCG vaccine to protect them from tuberculosis. In the 1940s and 1950s, annual chest x-rays were performed on hospital workers as a method for case detection of active tuberculosis. Since this was discovered to be a rather expensive, insensitive and nonspecific method for detecting tuberculosis, tuberculin skin testing has largely replaced the annual chest x-ray. In most medical centers in the US, tuberculin skin tests are now done annually to screen for recent tuberculosis infection.

Times have changed. Currently, only 7% of the general population is tuberculin test-positive, and this is true in only 3% of individuals who are age 20. In 1978, 12% of all new employees at Charity Hospital in New Orleans were found to be tuberculin-positive while a prevalence of 1.2%

was noted in younger and more affluent medical students beginning their hospital experience at Charity.³ At the Cleveland Clinic Foundation in 1983, 5.9% of 1,114 consecutive new employees were found to be tuberculin-positive.

The incidence of tuberculosis in the general population has been decreasing for many years. New active cases of tuberculosis dropped from 500/100,000 in the 1900s to 11.9/100,000 in 1981. In 1981, California had 18.7 new cases per 100,000,⁴ while in 1979 rural and small town Ohio had only 3.9 new cases per 100,000.⁵ The majority of patients were over 45 years of age, and presumably represented reactivation of old tuberculosis. In recent years, an average of five cases of respiratory tract tuberculosis have been detected annually in hospitalized patients at the Cleveland Clinic. This accounts for a very small incidence of disease since over 30,000 patients are hospitalized per year at our institution.

Tuberculin skin test conversion rates at the Cleveland Clinic Foundation for the years 1978 through 1982 are shown in Table 1. The annual conversion rate for all Foundation employees was approximately 0.5%. Conversion rates for other hospitals are listed in Table 2. These data show that the overall conversion rate is quite low and more significantly, that the groups with the highest conversion rates do not have significant exposure to patients. These groups are made up predominantly of inner-city minority persons. It would appear then, at least in hospitals with low conversion rates and low community rates of tuberculosis, that hospital workers are at no greater risk for acquiring tuberculosis than the average citizen.

There are situations in the hospital when a patient with tuberculosis is not identified at admission and more disturbing, is discovered only after a lengthy hospitalization. Each hospital must have a procedure for dealing with this type of unexpected exposure for hospital workers. However, during the past 10 years, conversion rates after

From the Departments of Primary Care and Infectious Disease, Cleveland Clinic Foundation, Cleveland, Ohio.

The skin testing program at the Cleveland Clinic Foundation was primarily the result of the work of Marie Murray, RN and Vincenzo Pontoni, RN. The authors also acknowledge Joan Brezinski and Mary Krosse for the manuscript preparation.

Address reprint requests to Gilbert Lowenthal, MD, Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44106.

TABLE 1
PPD CONVERSION RATES IN EMPLOYEES OF
THE CLEVELAND CLINIC FOUNDATION: 1978-1982

Departments*	Conversions† In Five Years	Average Annual Census	Average Annual Attack Rate
IV Team	2	20	2.00%
Primary Care	3	36	1.67%
Hospital Secretaries	3	55	1.09%
Pulmonary/Respiratory	3	56	1.07%
Patient Transportation	4	85	0.94%
Clinic Nursing	3	65	0.92%
Radiology	5	125	0.64%
Operating Rooms	3	175	0.57%
Hospital Nursing	13	2000	0.13%
Food Service	9	350	0.50%
Laundry	9	100	1.80%
Medical Records/Statistics	3	50	1.20%
Accounting	3	53	1.13%
Security	5	100	1.00%
Building Services	13	300	0.87%
Facilities Engineering	6	172	0.69%
Hematology Lab	3	88	0.68%
Blood Bank/Tissue Typing	2	60	0.67%

* Departments having at least two documented PPD conversions in five years.

† Data from routine annual testing (compliance = 85-90%). "Exposure" testing is not included.

exposure were only at 1% at Cornell Medical Center (W. Christiansen, personal communication), and less than 1% at both the Mayo Clinic (A. Miller, personal communication) and the Cleveland Clinic Foundation. Thus, it appears that even when unduly exposed, hospital workers rarely acquire tuberculosis.

It is possible that some apparent conversions (recent infection with tuberculosis) are actual old positive tuberculin reactions that are brought to the surface by the booster effect of tuberculin skin testing. It appears that the booster effect is of greatest significance among older people, particularly those living in the South.¹⁰ Valenti et al¹¹ showed that hospital employees in Rochester, New York, did not demonstrate a significant booster effect. At the Cleveland Clinic Foundation in 1984, 490 consecutive new employees with negative initial skin tests were retested for booster effect. Eight employees whose initial reaction was redness with questionable induration had a significant reaction with the second skin test. In no case was a positive result seen after a second skin test if that individual was completely negative to the first test.

Skin testing programs are expensive. Depending on the volume and efficiency, we estimate that the cost of skin testing runs from \$6 to \$23 per skin test (Table 3). It might cost \$4,600 to find one PPD converter!

Annual skin testing for all hospital personnel is now common in most medical centers in the United States. Such testing is encouraged by the Joint Commission on Accreditation of Hospitals and is often mandated by state health regulations. The American Thoracic Society statement on control of tuberculosis¹² recommends that the need for periodic repeat tuberculin testing should be

determined by the risk of acquiring a new infection and be based on the incidence of tuberculosis in the institution, the community and the institutional conversion rate. The CDC Guidelines for Infection Control in Hospital Personnel¹³ state that "the need for repeat testing should be determined in each hospital by the risk of acquiring new infections; for example, personnel need not have repeat testing if the incidence of tuberculosis in the community and in personnel is very low, and personnel have not been exposed to infective cases."

We agree that because of the dramatic change in prevalence of tuberculosis, full scale annual skin testing should go the way of annual chest x-rays and in general be abandoned in most medical centers. However, because of unique types of employees and patients, some hospitals should elect to continue selective tuberculosis surveillance.

At the Cleveland Clinic Foundation, we perform annual tuberculin skin testing on respiratory therapists, pathology workers, and selected laboratory personnel, including those in the microbiology laboratory. Hospital nursing and other clinical employees are tuberculin tested every 3 years and non-clinical employees, such as those working in building service, accounting, and security are tested every 5 years. Departments with presumed high community exposure such as laundry are also tested every 3 years. We obviously believe that those whom we test every 5 years are unlikely to acquire tuberculosis from either hospital exposure or the community while those whom we test more frequently are at some greater risk.

All converters regardless of age are offered INH and

TABLE 2
PPD CONVERSION RATES AMONG EMPLOYEES IN US HOSPITALS

Site	Years	Annual PPD Tests	Annual Conversion Rate		Highest Department
			High	Average	
Charlottesville ⁶	1968-69	1800		1.9	
Salt Lake City ⁷	1972-76	1500		0.11	
Baltimore ⁸	1971-76	1000	6.9	1.0	Laundry/Housekeeping
Buffalo ⁹	1975-78	1300	6.8	0.5	Housekeeping
Augusta (P. Seamon, personal communication)	1982-83	2000		1.0	
Cleveland Clinic	1978-82	3800	1.8	0.5	Laundry

most accept it. Those over 35 years are kept under closer medical surveillance while on the drug.

Our recommendations are as follows:

1. Skin test all (historically PPD negative) new employees and consider retesting immediately (to rule out a booster effect) if the employee is greater than 45 years of age or if there is redness or less than 10 mm of induration on the original skin test.
2. Refrain from performing chest x-rays on new employees who are tuberculin-negative.
3. Determine the true conversion rates for different employee groups (ie, ward nursing, clinic nursing, employees working in laundry, security, etc.).
4. Modify program by retesting frequently only those employees with high contact (regardless of whether this might occur in the community or at work), or those where the employee to patient transmission potential would be of serious consequence (such as a newborn nursery or ward housing immunocompromised patients).
6. Offer Isoniazid to all tuberculin skin test-positive employees under age 35 years and in all those who are documented to be true tuberculin converters.
6. Refrain from obtaining annual chest x-rays on employees who are asymptomatic but are known to be tuberculin skin test positive.
7. Have a procedure for evaluation and follow-up after excessive or unexpected exposure to active respiratory tuberculosis.

REFERENCES

1. Reid DD: Incidence of tuberculosis among workers in medical laboratories. *Br Med J* 1957; 2:10-14.

TABLE 3
COST OF PPD SKIN TESTING PROGRAM

Material	\$1.00
Record Keeper	\$1.00 — \$2.00
Nursing Time	\$3.00 — \$10.00
Patient Time	\$1.00 — \$10.00
Total	\$6.00 — \$23.00

2. Ashley MJ, Wigle WD: The epidemiology of tuberculosis in hospital employees in Ontario, 1966-1969. *Am Rev Respir Dis* December 1971; 104:851-860.

3. Pitchenik AB: PPD-tuberculin and PPD-battery dual skin testing of hospital employees and medical students. *South Med J* August 1978; 71:917-922.

4. "Tuberculosis—United States, 1981." *Morbidity and Mortality Weekly Report*, US Department of Health, 1982; 31:443-446.

5. "Tuberculosis," *Ohio Department of Health and Communicable Disease Newsletter* 4(2), February 1980.

6. Atuk NO, Hunt EH: Serial tuberculin testing and isoniazid therapy in general hospital employees. *JAMA* 1971; 218:1795-1798.

7. Vogler DM, Burke JP: Tuberculosis screening for hospital employees. A five-year experience in a large community hospital. *Am Rev Respir Dis* 1978; 117:227-232.

8. Berman J, Levin ML, Orr SI, et al: Tuberculosis risk for hospital employees: Analysis of a five-year tuberculin skin testing program. *Am J Public Health* 1981; 71:1217-1222.

9. Faden HS, Lee J, Ogra PL: Employee health screening; in pediatric hospital. *NY State J Med* 1979; 1708-1711.

10. Thompson NJ, Glassroth JL, Snider DE, Jr, et al: The booster phenomenon in serial tuberculin testing. *Am Rev Respir Dis* 1979; 119:587-597.

11. Valenti WM, Andrews BA, Presley BA, et al: Absence of the booster phenomenon in serial tuberculin skin testing. *Am Rev Respir Dis* 1982; 125:323-325.

12. American Thoracic Society Statement: Control of Tuberculosis. *Am Rev Respir Dis* 1983; 128:336-342.

13. Williams WW: CDC Guidelines for Infection Control in Hospital Personnel. *Infect Control* 1983; 4:336-337.