

Editorial

Is a Tuberculosis Exposure a Tuberculosis Exposure If No One Is Infected?

Edward A. Nardell, MD

If this sounds like a capricious question, understand that I am writing this commentary after a very long day listening to 7 hours of testimony on the proposed Occupational Health and Safety Administration (OSHA) tuberculosis (TB) Standard by the Association of Practitioners in Infection Control (APIC), the American Hospital Association (AHA), and other concerned organizations, followed by 3 hours testifying and questioning on the response of the American Lung Association and the American Thoracic Society, whom I represented. I shouldn't complain. OSHA officials will have listened to 8 days of similar testimony, much of it critical of their proposal, in this the first of four hearing sites around the country. The Society for Healthcare Epidemiology of America representatives will offer testimony at the New York City hearing in June. After more than a decade of debating the protection of healthcare and other institutional workers, visitors, and residents, it is clear that there is as yet no consensus on either the TB risk for institutional workers or the best available means for monitoring and control. The closest thing to a consensus has been the 1994 Centers for Disease Control and Prevention (CDC) guidelines, which also drew heavy fire in its draft form, but which have proven to be flexible enough for use in many institutional settings. Three California hospitals, however, may have been too flexible in their application of the CDC guidelines, with consequent potential exposure of healthcare workers, according to a survey by Sutton et al in this issue of the Journal.¹

In what must have been something like a voluntary OSHA inspection, the authors reviewed and compared the written TB infection control plans of two county and one private hospital to actual practices, including, among other components, the measurement of negative pressure, room directional airflow and mixing, and the use of particulate

respirators. Unfortunately, all three hospitals had multiple deficiencies in most areas, according to the authors. The findings demonstrate what has long been known to those experienced in indoor air quality—that poor maintenance, more than poor design, is the main barrier to healthful air in most settings. While these deficiencies should not have occurred and should be corrected, that they did occur in presumably well-run institutions is probably more often the rule than the exception. The expectation that ventilation systems consistently will perform as designed, however desirable, may be unrealistic and part of the problem of achieving TB infection control today.

Complex mechanical systems in hospitals that may contain as many as 50 to 75 isolation rooms are difficult to maintain through seasonal changeovers, personnel changes, renovations, competing pressure fluctuations, and system aging. Mustering the administrative will to devote the kinds of resources needed to maintain mechanical systems, as well as fit-test respirators, flawlessly, to educate and skin-test workers, and to maintain the other infection control components usually requires convincing evidence that failing to do so will be linked closely to bad outcomes. This happened in high-prevalence hospitals in New York City, Miami, and Atlanta in the early 1990s, leading to the success stories in TB infection control in those cities that have been cited widely as endorsements for the 1994 guidelines. Under the less-acute, lower-prevalence conditions extant in much of the country today, however, where over 100 patients may be isolated without TB for every case with the disease and where false-positive skin tests may outnumber true conversions, it often is difficult to generate the enthusiasm and resources necessary to implement and maintain infection control practices as currently recommended. As TB case rates fall, at some point it will be necessary to reassess the risk of institutional TB

From Cambridge Hospital, Cambridge, Massachusetts.

Address reprint requests to Ed Nardell, MD, Department of Medicine, Cambridge Hospital, 1493 Cambridge St, Cambridge, MA 02139.

98-ED-036. Nardell EA. Is a tuberculosis exposure a tuberculosis exposure if no one is infected? Infect Control Hosp Epidemiol 1998;19:484-486.

transmission and adjust control strategies accordingly. This is a provocative statement in view of OSHA's current proposed TB standard, which seeks to codify interventions developed under the threat of higher-risk conditions that existed over 5 years ago.

In the high-risk hospitals surveyed by Sutton and colleagues, I fully expected to be told that the multiple deficiencies identified were associated with an excessive rate of skin-test conversions among healthcare workers, just as improved practices have been correlated with decreased infection rates in other institutions. No mention was made of skin testing or conversion rates, although testing surely was done. One is tempted to suspect that conversion rates were not excessive, leading to the question that titles this commentary. In the Sutton article, less than full compliance with the 1994 CDC guidelines essentially is equated with exposure, regardless of the actual skin-test conversion rate. Given that many components of the current guidelines, such as 6 to 12 air changes per hour or the use of fit-tested N95 respirators, are based more on expert opinion than hard science or TB field studies, it probably should not be surprising that deviations from one or more recommendation may not predictably lead to increased infection rates. Great variability in the number and infectiousness of TB source cases is another possible explanation for low infection rates in a relatively small study. Moreover, there is consensus among TB and infection control experts that the greatest risk for TB transmission is not the identified infectious case in an isolation room but the unsuspected case in the waiting room, critical-care unit, or orthopedic bed. Lacking diagnostic tests with high negative predictive value, efforts to identify and isolate all potentially infectious cases through use of a low clinical threshold leads to high rates of overisolation under low-prevalence conditions. I estimate that, in most parts of the country, TB isolation rooms are occupied by persons without TB 95% to 99% of the time, even though TB patients stay longer than patients in whom TB is ruled out. From this perspective, less than perfect air mixing in an isolation room, a small door leak, or a respirator face-seal leak of 20% rather than 10% may make little practical difference to worker skin-test conversions, despite theoretical models that predict otherwise. With the important exception of multiply drug-resistant (MDR) TB and rare highly infectious cases, under most circumstances, isolation rooms are not likely to be very dangerous places even when they are not functioning flawlessly. The same is true, but to a greater degree, in TB clinics in low-prevalence areas like Massachusetts, where no skin-test conversions have been recorded in the last 3 years in a prospective CDC study conducted at 26 sites.

A point of contention during the OSHA TB Standard hearing that I attended was the current TB risk for healthcare workers. The American Thoracic Society response cited a recently published CDC study of occupational TB where, as a group, healthcare workers had TB rates similar to the general population.² Elevated rates of active TB

were found only for respiratory therapists and "low-paid healthcare workers." In a recent National Institute for Occupational Safety and Health occupational TB mortality study, only white male health and nursing aides, orderlies, and attendants were associated with increased risk of death from TB, and they were thankfully few.³ Finally, preliminary results on a prospective TB infection study of health workers were presented by the CDC at the 1997 meeting of the International Union Against Tuberculosis and Lung Disease, North American Region.⁴ Based on 9,088 of 29,004 workers initially negative by two-step testing, annual TB conversion rates were found to be 0.3% for social workers, 0.6% for attending physicians, 0.8% for administrators, 1% for interns and residents, 1.2% for nurses and housekeepers, and 3.1% for nursing aides. Of note, the rate was 0.7% for US-born workers compared to 4.6% for foreign-born workers, 0.5% for white compared to 1.8% for nonwhite workers, and 0.7% for unvaccinated workers compared to 5.2% for bacille Calmette-Guérin (BCG)-vaccinated workers. The overall conversion rate reported in March 1997 was 1.1%, but additional data gathered since the preliminary report has shown a slight drop to 0.9% (oral communication, YM Davis, VMD, MPH, CDC, February 20, 1998). Like the first two studies quoted above, with the exception of respiratory therapists, the greatest risk for TB infection or disease among healthcare workers appears to be among persons where residual BCG-boosting or community transmission are possible explanations. These data contrast with the endorsement of Sutton and colleagues for OSHA's presumption of work-relatedness for TB acquired by healthcare workers.

Although there is growing evidence that the risk of TB transmission for most health workers in the United States is low and should decline further, along with projected case rates, the situation is the reverse in the developing world. Outbreaks of MDR TB, often involving human immunodeficiency virus disease, increasingly are being recognized as important threats to healthcare workers and other patients. Under high-prevalence conditions, where the cost and availability of first-line TB drugs are barriers to effective therapy and MDR TB is not effectively treated at all, protection of workers is unlikely to rely heavily on expensive mechanical ventilation and personal respiratory protection. Community-based programs, where patients receive short-course, directly observed therapy outside of hospitals, thereby reducing infectiousness and reducing healthcare worker exposure, may offer the best prospect of preventing nosocomial transmission. Finding resources and expertise to treat chronically infectious MDR cases effectively will be another important step in reducing transmission in developing countries. Such interventions will have direct benefits for the United States as well, given the increasing contribution of foreign-born persons to TB morbidity. In Massachusetts, for example, 70% of all cases in 1997 were foreign-born, as were all six of our MDR TB cases. In data presented by APIC at the OSHA hearings, 51% of healthcare workers with TB were foreign-born in

1997, compared to 39% of TB cases in the general population, suggesting an important contribution of infection acquired abroad or in the community (unpublished data, CDC, 1997). As domestic case rates fall, federal, state and other concerned agencies would do well to increase support for global TB control, both through direct financial aid and through cooperative agreements whereby our abundant clinical, laboratory, and training capability is put to good use where the problem is greatest. As we struggle with how much of our ample but still limited resources to allocate to TB infection control amid falling case rates, it is sobering (albeit nonproductive) to contemplate how much TB control the cost of one TB isolation room would buy in the developing world, where an uncomplicated case of TB in Malawi, for example, can be treated fully for approximately \$24. The reality is that US health workers must be

protected, and TB cases in resource-poor countries must be treated. The challenge before this resource-rich country is to allocate resources toward both objectives in the most effective, efficient, and ethical way.

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