Editorial

Administrative Controls for TB: "Keep Doing What You've Always Done, and You'll Get What You Always Got"

Rebecca Wurtz, MD, MPH

The most important part of tuberculosis (TB) infection control is getting the patient into the isolation room. Once a patient is in a room that has negative air flow and at least six air changes per hour, it probably doesn't matter much if the healthcare worker wears a fit-checked National Institute for Occupational Safety and Health (NIOSH)-approved mask or what wavelength the light is. What happens when we fail to isolate a patient with TB? At the least, an unisolated patient launches a costly and time-consuming exposure investigation and, at the very worst, the patient transmits a fatal infection. Menzies and colleagues[1] recently summarized a number of reports on occupational exposure to TB. In a wide range of hospital situations, the diagnosis of TB was missed on admission 40% to 50% of the time. Delays before isolation averaged 6 days, resulting in the exposure of 27 to 188 healthcare workers and tuberculin skin-test conversions in anywhere from 14% to 55% of exposed employees. Transmission to other patients is less easy to quantify, but we know it occurs.

How can we decide whom to isolate? Pegues and colleagues[2] propose a simple algorithm—which includes a few risk factors, a few symptoms, and chest x-ray (CXR) findings—to identify TB patients on admission. They implemented it in a hospital admitting an average of approximately 15 TB patients per year, a number very similar to the mean number of TB patients admitted to hospitals across the United States.[3]

This simple algorithm doesn't work, at least not if you view the glass as half empty or, in this instance, 39% empty. The admission algorithm failed to identify 39% of patients who ultimately were diagnosed with TB, exposing at least 11 other patients and 281 employees to TB, although no one converted a tuberculin skin test.

Why did it fail? In one half of the failures, healthcare workers did not apply the algorithm properly—the patient should have been isolated, but wasn't. Who didn't use the algorithm properly? Pegues and colleagues don't say, but imply that it was emergency room and admitting doctors. In some of the other failures, the algorithm itself was incomplete—it did not include age as a risk factor for TB, although the Centers for Disease Control and Prevention considers the elderly to be at risk.[4]

There are several surprising things about Pegues' report. Pegues and colleagues don't compare the years prior to the implementation of the algorithm, to see if the algorithm improved the rate of isolation. Perhaps there was a significant improvement; however, we are still left with a failure rate of nearly 40%, similar to the failure rates summarized by Menzies. Second, 19% of all patients evaluated for TB had positive acid-fast bacilli (AFB) smears but negative cultures for any mycobacterial species, a surprisingly high smear false-positive rate. The authors don't explain the circumstances surrounding these specimens, but I can imagine that such a high false-positive rate would complicate effective evaluation of possible TB patients.

From the Department of Medicine, Evanston Hospital, Evanston, Illinois, and the Department of Medicine, Northwestern University Medical School, Chicago, Illinois.

Address reprint requests to Rebecca Wurtz, MD, MPH, Evanston Hospital, 2650 Ridge Ave, Evanston IL 60201; e-mail, rwurtz@nwu.edu.

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Pegues' report also is surprising in that the hospital it describes has a wealth of isolation resources—48 negative-pressure isolation rooms—and yet, according to this report, very few patients were admitted to isolation for evaluation of TB. In other reports, hospitals diagnosing only a few TB patients each year usually admit many patients to isolation to rule out TB relative to the number of patients actually diagnosed with TB (what I call the rule-out ratio). For example, the Clinical Center at the National Institutes of Health (NIH), where TB is an uncommon diagnosis, reported a rule-out ratio of 14.5 to 1; during an 18-month period, they isolated 29 patients and diagnosed TB in only two.[5] The ratio for hospitals admitting many TB patients, such as Grady Memorial in Atlanta, St Clare's in New York, and Cook County in Chicago, is lower, on the order of 7 to 1. Healthcare workers at hospitals admitting fewer patients may be less comfortable with their ability to recognize TB, or these hospitals may admit fewer HIV patients, or the denominator simply may be smaller; the reason for the higher ratio isn't completely clear. Pegues and colleagues report evaluating 69 patients for TB, but isolating just 43 patients, including 26 who had TB, for a rule-out ratio of just 1.7 (that is, 43 to 26). This low ratio, in combination with the high fraction of TB patients being missed, suggests that more patients should be isolated on admission.

The failure of this algorithm is not unusual—many hospitals have tried similar approaches and have been disappointed with the results. Despite enormous efforts across many disciplines to design and enforce these algorithms, they fail. Any system that relies on people with variable interest and experience in TB to make a series of sophisticated judgments, based on incomplete information, in order to admit someone to isolation will not work smoothly.

Perhaps instead of trying to design the best admission algorithm—instead of trying to recognize a TB patient as he walks in the door—we should take a less specific, more sensitive approach and automatically admit to isolation all patients with CXR abnormalities or any symptom potentially attributable to TB. We then could direct our attention toward abbreviating isolation for those patients who don't need it, accelerating the rule-out evaluation. In other words, perhaps we should isolate first and ask questions, as rapidly and cost-effectively as possible, next.

How could we shorten the length of stay in isolation? Some hospitals with large numbers of TB patients have assigned an individual or a team the job of reviewing and expediting the evaluation of isolation patients,[6] but hospitals with fewer patients could develop a paper pathway that is implemented by the nurse and the doctor on the patient-care unit. We could critically evaluate some of the time-honored but untested approaches to diagnosing TB. Are morning sputums on 3 consecutive days really better than three induced sputums obtained over a much shorter period of time? What is the safest and most cost-effective use of bronchoscopy? What's the best use of the new amplified direct sputum smear DNA probe? The use of this direct test is limited to smear-positive specimens, but, as we learn more about its negative predictive value in different settings, we may be able to use a negative result to confirm that a positive AFB smear represents a mycobacterium other than TB and remove a patient from isolation.

If we isolated all of Pegues' patients, whom would we have missed? Based on the numbers in the article, we would have isolated 69 people and missed none with TB. All of the TB patients had a CXR abnormality or a symptom suggestive of TB.

If we applied this approach to Pegues' patients, how much would it have cost? Depending on the hospital, the added charges associated with isolation can be a little or a lot. My hospital charges $90 more for an isolation room than for a private room. At Cook County Hospital, however, daily isolation room charges (for single room with private bath) are $850, compared to $550 for a regular bed on a large, semi-open ward. The additional cost of isolating someone, distinguished from the charge, includes the cost of masks for respiratory protection, and heating and cooling loss due to external ventilation. Some hospitals, including the hospital in this report, can selectively turn the exhaust fan on when the room is occupied by a rule-out TB patient; thus, the heating, ventilation, and air conditioning (HVAC) losses increase when someone is admitted to isolation. For other hospitals, where the ventilation patterns are fixed, putting someone in isolation does not increase the fixed HVAC losses. The direct sputum DNA probe costs approximately $25 per test; charges obviously will be higher. Beekman et al, at the NIH, estimated an added cost of $81 per day per patient in isolation.[5]

However, failure to isolate costs money, too, including the personnel costs for exposure investigations and tuberculin skin testing; and, if tuberculin skin-test conversions occur, the costs of evaluation, prophylaxis, and (when necessary) treatment. The data presented by Pegues don't allow us to calculate costs. However, if we estimate that it takes 30 minutes round-trip for a healthcare worker to go to the employee health service and have a tuberculin skin-test placed, that each exposed healthcare worker

must have two skin tests, and that an average hourly wage for hospital workers is $17, then the lost personnel time for skin testing alone would have cost $4,777 (1 hour × $17 × 281 employees), enough to cover the costs of an additional 59 days (at $81 a day) in isolation. This would have covered the added costs of 2.3 days in isolation for each of the 26 patients—both case-patients and rule-out TB patients—who were unisolated.

Clearly, the incidence and epidemiology of TB and the isolation resources differ from hospital to hospital. The balance between cost and benefit of aggressive isolation will be different at different institutions. However, over many years and in many situations, trying to figure out at the door if a patient has TB hasn't worked and will continue not to work. We need a new approach. Or to quote Dixie Snider, "keep doing what you've always done, and you'll get what you always got."[7]

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OSHA's Susan Harwood Dies

Gina Pugliese, RN, MS
Martin S. Favero, PhD
Medical News Editors

Susan Eileen Harwood, Director of the Office of Risk Assessment, Health Standards Program at the Occupational Safety and Health Administration (OSHA) passed away on April 15, 1996, following a brief illness. Susan became well known to the infection control community through her leadership in the development of the Bloodborne Pathogen Standard. For the past 3 years, she has been involved in the development of a standard for tuberculosis. Susan also was responsible for implementing innovative strategies at OSHA, including a series of stockholders' meetings to obtain input on the proposed tuberculosis standard from a number of organizations, including SHEA and APIC. Susan was committed to the protection of employee health and, in furthering that goal, she was able to bridge the gap between workers, management, and regulatory and nonregulatory government agencies. She always was ready and willing to listen to another point of view or additional documentation to support a different approach in assuring worker safety and health. As a physician with an interest in biologic hazards to workers, Susan was particularly in tune with many of the concerns of the infection control community. Susan truly will be missed.