Tracing Patients Exposed to Health Care Workers with Tuberculosis

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SYNOPSIS

Objectives. Following an outbreak of tuberculosis (TB) among health care workers at a public hospital, the study was undertaken to (*a*) locate all exposed patients and administer tuberculin skin tests (TSTs) to them, (*b*) provide clinical treatment or prophylaxis to infected patients, and (*c*) ascertain the risk of *M. tuberculosis* transmission from health care workers to patients.

Methods. The authors identified all patients who had been hospitalized on floors where health care workers with symptomatic TB worked. The staff of the hospital's outpatient HIV/AIDS clinic notified and evaluated clinic patients who had been hospitalized on those floors. County health department personnel attempted to contact the remaining patients by letter and phone.

Results. The authors identified 586 patients hospitalized during the health care worker outbreak, of whom 503 were potentially susceptible. Of these, 172 (34.2%) could be contacted, and 138 (80.2%) completed tuberculin skin testing or other follow-up evaluation. Of 134 who completed testing, 28 (20.9%) had reactive TSTs. In all, 362 patients (72%) were lost to follow-up, including many HIV-positive and homeless patients, who are at high risk of developing active TB once infected with *M. tuberculosis*.

Conclusions. The reemergence of TB as a public health threat and the emergence of other infectious diseases make it imperative to elicit accurate addresses and contact information from hospitalized patients and to develop better methods of contacting patients after hospital discharge.

Recent nosocomial outbreaks of tuberculosis (TB) have highlighted the risk of patient-to-patient and patient-to-health care worker transmission.[1–4] A 1992 outbreak in an inner-city public hospital in Atlanta, Georgia, involved the transmission of *Mycobacterium tuberculosis* from health care worker to health care worker. Two hospital wards were affected, 50 health care workers were identified with new *M. tuberculosis* infections indicated by tuberculin skin test (TST) conversions, and eight of these workers (16%) developed active disease.[5] The hospital serves numerous indigent and homeless patients, many of whom are infected with human immunodeficiency virus (HIV). Because some of the health care workers with active TB continued patient care activities while

symptomatic with undiagnosed TB and because of the high transmission rate among health care workers (38% of the workers on the two wards had new infections), the possibility of *M. tuberculosis* transmission from health care workers to patients had to be considered.

We sought to identify, locate, evaluate, and, as necessary, treat patients who had been hospitalized on floors where infectious health care workers had worked. The baseline TB infection status of most patients was not known; therefore, we were unable to determine if a reactive TST indicated recent infection with *M. tuberculosis* or represented a prevalent case. In addition, the prevalence of TST reactivity in the population from which the patients were drawn is not known. We hypothesized that had *M. tuberculosis* been transmitted from health care workers to patients, the highest rates of TST reactivity would be among those with the greatest risk of exposure.

The objectives of this study were (*a*) to locate and administer a TST to all exposed patients, (*b*) to provide clinical treatment or prophylaxis to infected patients, and (*c*) to ascertain the risk of *M. tuberculosis* transmission from health care workers to patients.

The reemergence of TB and the emergence of other serious infectious diseases increase the possibility that hospitalized patients will be exposed to other patients or health care workers with infectious diseases.

Methods

Approximately six months after the conclusion of the health care worker outbreak, we used computerized records of admissions and transfers to identify all patients who were hospitalized on floors where health care workers with untreated, symptomatic TB worked (symptoms included cough, chest pain, and fever).[5] Exposed patients were divided into two categories based on the dates and ward on which they were hospitalized: *(a)* high risk exposure—patients exposed to a confirmed source health care worker (defined as a worker with acid fast bacillus [AFB]-positive sputum smear or a cavitary lesion on chest X-ray). *(b)* low risk exposure—patients exposed to a possible source health care worker (defined as a symptomatic worker with unknown sputum smear status).

In addition, patients were stratified by their HIV-infection status (positive or negative), which was identified by discharge diagnoses during a computerized medical record review, since HIV-infected patients are more likely than HIV-negative patients to have risk factors for *M. tuberculosis* infection such as drug use and homelessness and may have higher baseline rates of TST reactivity. We thus created four categories among which to examine the rates of TST reactivity, in order of decreasing expected rate of TST reactivity: *(a)* high risk exposure and HIV positive; *(b)* high risk exposure and HIV negative; *(c)* low risk exposure and HIV positive; *(d)* low risk exposure and HIV negative.

The names and exposure categories of HIV-infected patients who were regularly followed in the hospital outpatient infectious disease clinic were provided to clinic personnel for follow-up. Clinic personnel tested HIV-infected patients at their next scheduled appointment. The evaluations of HIV-infected patients included TST (including placement of control antigens due to a high risk of anergy—the inability to mount an immune response), chest X-ray, and sputum smear for AFB.

The names, addresses, and exposure categories of the remaining patients were provided to the two health departments in counties where the majority of patients lived. County health department personnel were requested to focus their efforts on locating patients who were known to be HIV-infected because of their increased risk of developing active TB once infected with *M. tuberculosis*. TB caseworkers from the two county health departments attempted to contact each patient two to five times by letter or telephone or both before designating a patient as lost to follow-up. When contacted, patients were informed of their recent possible TB exposure and were asked to go to any county health department clinic in their county of residence for an evaluation. These evaluations consisted of TST placement and reading and, in the event of a positive TST, a chest X-ray.

Data were entered and analyzed using EpiInfo Software, Version 6.[6] The proportion of TST-reactive patients was calculated for each of the four exposure categories. Relative risk estimates and 95% confidence intervals were calculated to compare groups. Rates of TST reactivity in each of the four exposure categories were directly compared using the chi-square test.

Results

We identified 586 patients who had been hospitalized on either of the two wards where health care workers with active TB worked. (See Table.) Some patients were hospitalized on more than one occasion; in those instances, the patient was assigned to the highest applicable exposure category. Of the 586 patients, 48 died shortly after hospitalization and 35 had a hospital admission diagnosis of TB or a reactive TST on admission (as recorded in discharge summaries); these patients were excluded from further follow-up.

Hospitalized patients exposed to health care workers with possible and confirmed TB: exposure categories and follow-up status[a] (*N*=581 patients)

Exposure category		All patients		History of TB or died after hospital		Remaining after exclusion		Completed testing		Lost to follow-up	
Patient HIV status	Level of exposure[b]	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Positive.....	High risk	65	11.2	16	19.3	49	9.9	18	13.0	31	8.6
Positive.....	Low risk	26	4.5	2	2.4	24	4.8	7	5.1	17	4.7
Negative.....	High risk	321	55.2	51	61.4	270	54.2	88	63.8	182	50.6
Negative.....	Low risk	169	29.1	14	16.9	155	31.1	25	18.1	130	36.1
Totals.....		581[a]	100.0	83	100.0	498	100.00	138	100.0	360[a]	100.0

NOTES: Percentages are of the column totals; comparison of last two columns, $\chi^2 = 15.61$ (degrees of freedom = 3), P=0.001.

[a]Total does not include five patients whose exposure status could not be determined because of incomplete hospital admission information.

[b]High risk exposure is defined as exposure to a confirmed source health care worker (a worker with an AFB-positive sputum smear or a cavitary lesion on chest X-ray). Low risk exposure is defined as exposure to a possible source health care worker (a symptomatic worker with unknown sputum smear status).

AFB=acid fast bacillus

Among the remaining 503 potentially infected patients, no address or an insufficient address was listed in the hospital chart for 139 (27.6%). In addition, 192 patients (38.2%) could not be located at the addresses provided in their hospital charts.

Of the 172 patients who could be located (34.2% of 503), 34 (19.8% of 172) did not keep appointments for testing and 138 (80.2% of 172) completed an evaluation for *M. tuberculosis* infection. (See Figure.) TSTs were administered to 134 of these patients; 28 (20.9%) had reactive TSTs. All but two of these 28 TST-reactive patients had a chest X-ray taken. No findings consistent with TB were identified among the 28 patients, nor did any of the 28 report symptoms consistent with TB. Eight HIV-positive patients with nonreactive TSTs were found to be anergic. All of these patients had chest X-rays and gave sputum samples; none were symptomatic, had findings consistent with TB on chest X-ray, or had AFB-positive sputum smears or cultures. TSTs were not performed on four HIV-positive patients who had a history of anergy; none of the four reported symptoms consistent with TB, had findings consistent with TB on chest X-ray, or had an AFB-positive sputum smear or culture. Based on their negative clinical, laboratory, and chest X-ray examinations, anergic patients and patients undergoing other examinations in lieu of TSTs were included with nonreactive TST patients for further analyses.

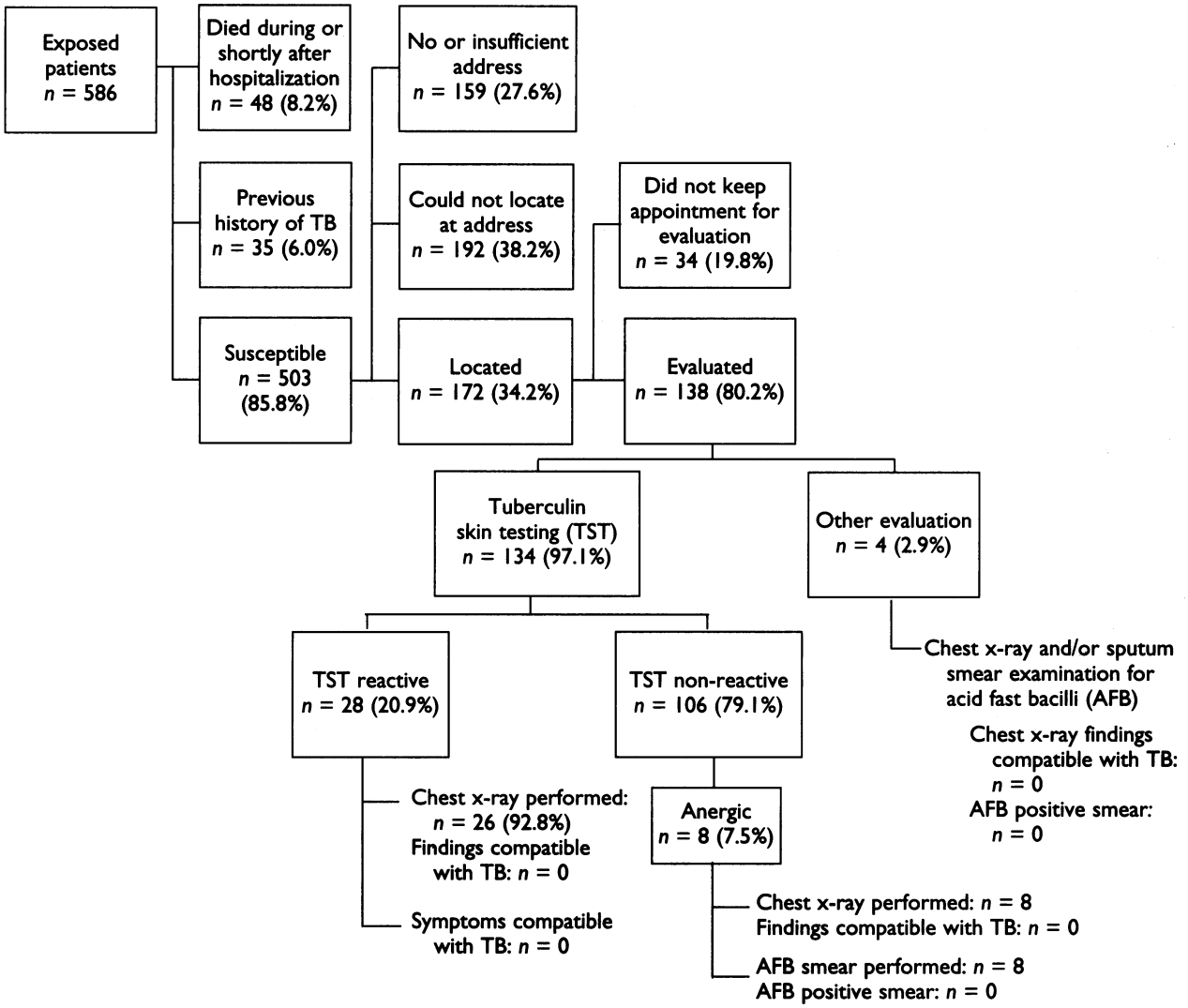
Better methods are needed to enable hospital personnel to contact patients after they have been discharged.

Because five of the 586 patients did not have sufficient information in their medical records to be classified into an exposure categories, they were excluded from further analyses. (See Table.)

Among the 138 patients who completed an evaluation, those exposed to a health care worker with a positive AFB smear or cavitary TB were not more likely to be TST-reactive than patients exposed to symptomatic health care workers with unknown AFB sputum smear status (19/106 versus 9/32, relative risk [RR] = 0.64; 95% confidence interval [CI] = 0.32, 1.27). Of the 138 evaluated patients, 25 (18.1%) were HIV-positive. HIV-positive patients were not more likely to be TST-reactive than were HIV-negative patients (3/25 versus 25/113, RR = 0.54; 95% CI = 0.18, 1.66). In addition, no association was found between exposure category and TST result ($\chi^2 = 5.98$, degrees of freedom [df] = 3, $P = 0.11$).

However, the 138 patients who were located and who completed testing did differ from those of the 360 susceptible, living patients who were lost to follow-up ($\chi^2 = 15.61$, df = 3, $P = 0.001$). Patients lost to follow-up were more likely to be in the group with the lowest risk of infection: HIV-negative patients exposed to a possible source health care worker.

Figure. Follow-up status of 586 hospital patients exposed to health care workers with symptomatic tuberculosis (TB)



Discussion

In the United States, surveillance for TB patients and contact tracing to identify and treat infected contacts are the mainstays of TB control.[7] In this inner-city population, only 138 (27.4%) of 503 susceptible patients potentially exposed to health care workers with TB were located and adequately evaluated for *M. tuberculosis* infection. Barriers to contact tracing included incomplete addresses in hospital records, the difficulty of locating homeless patients, lack of response to repeated written or telephone requests to come in for evaluation, and lack of sufficient resources to allow hospital and county health personnel to go to the patients for the evaluation.

This investigation did not provide conclusive evidence of an increased risk of *M. tuberculosis* transmission from symptomatic health care workers to patients. Patients in the group with the lowest risk of *M. tuberculosis* transmission were more likely to be lost to follow-up than patients in the other exposure categories, reflecting the county health departments' greater efforts to locate high risk patients.

For two reasons, however, our study does suggest that better methods are needed to enable hospital personnel to contact patients after they have been discharged. First, the low response rate of 27.4% is of concern given the large number of HIV-infected and homeless patients who were lost to follow-up, who may be at particularly high risk of developing active TB once infected with *M. tuberculosis*. A second concern is evidence found in a separate analysis of this outbreak of patient-to-patient *M. tuberculosis* transmission (Unpublished data, Susan Ray, 1996) and the difficulty of locating, testing, and treating those patients who were exposed to infectious TB patients.

The reemergence of TB and the emergence of other serious infectious diseases increase the possibility that hospitalized patients will be exposed to other patients or health care workers with infectious diseases. In light of this, it is imperative that hospitalized patients be traceable in the event of an outbreak of infectious disease. The problem of incomplete addresses in hospital records can be resolved more easily than the complex problem of locating and maintaining contact with homeless patients. Hospital personnel should try to ensure that addresses are accurate. In addition, the names of people who are likely to know how to contact the patient should be elicited from hospitalized patients. To increase contact with homeless populations, hospital outreach workers should develop ongoing relationships with local shelters and single-room-occupancy hotels.

In our investigation, extraordinary efforts to reach potential patient contacts of infectious health care workers were largely unsuccessful. However, testing of the high risk patients we were able to reach suggests that the *M. tuberculosis* transmission risk was low. The procedure for contact tracing usually involves only one attempt at reaching potential infectious disease contacts; this limited effort would have resulted in even fewer patients being located, tested, and treated. To prevent continued community transmission of infectious diseases acquired in hospital settings, mechanisms are needed for ensuring contact with patients after they are discharged from the hospital.

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