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Investigation of sudden death from *Mycobacterium tuberculosis* in a foreign-born worker at a resort hotel

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A 60 year-old man born in Central America died suddenly in the hallway of his residence on the grounds of a resort hotel where he worked as a dishwasher. The dishwashing station was in a large, poorly ventilated area where a substantial number of food service workers (cooks, wait staff, bus persons, dishwashers, supervisors, etc.) shared air space with the index patient. Several social contacts of the patient reported that he had been coughing for many months before his death. The County Department Of Health conducted a contact investigation, which identified 171 individuals in need of follow-up. Thirty-six percent of those tested in the first round were tuberculin skin test-positive; a second round of testing yielded a 15% (8 of 52) conversion rate. (Heart Lung@ 2004;33:333-7.)

In the late 19th century, tuberculosis (TB) killed 1 of every 7 people living in the United States and Europe.¹ Today, TB kills approximately 2 million people worldwide annually, and without further intervention during the period 2002 through 2020, approximately 1 billion people will be newly infected, 150 million people will become ill, and 36 million people will die of TB.²

The annual incidence of TB has decreased substantially during the past century in the United States. The increased morbidity that occurred during the late 1980s and early 1990s has decreased, and cases reported nationally reached a record low number of 15,078 in 2002.³ The annual number of deaths caused by TB has also decreased in recent years; between 1980 and 2000, national TB deaths decreased from 1,978 to 751.⁴

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While under treatment for TB, a proportion of individuals die from the disease. In India, 6% of 676 patients age 14 to 87 years old died in a directly observed therapy program. Death rates were independently associated with weight <35 kg and history of previous treatment.⁵ A study in Mexico found that the risk of death from pulmonary TB was associated with delays in treatment after the onset of disease and to poor adherence by patients to the treatment regimen.⁶ In Ghana, patients who died were likely to be human immunodeficiency virus (HIV)-positive, to be older, live in a rural area, have sputum smear-negative disease, and prolonged duration of symptoms before diagnosis.⁷ A United Kingdom study indicated that delay in diagnosis was the main contributing factor leading to death from TB.⁸ Delayed diagnosis of active pulmonary TB among hospitalized patients (which leads to greater morbidity, mortality, and transmission of infection) in Canada was associated with atypical clinical and demographic characteristics.⁹ An investigation conducted among inner city residents in a large United States city identified predictors of death to be underlying illnesses such as diabetes mellitus, renal failure, chronic obstructive pulmonary disease, and HIV infection.¹⁰ Cases of TB can go undetected until discovered after death. Among 3,102 TB cases in

San Francisco, California, 4% were identified at death. Factors associated with these cases were age ≥ 43 years, male sex, white race, birth in the United States, and injecting drug use.¹¹ Death from TB may sometimes have a rapid onset and progression. TB-related sudden death has been related to bronchopneumonia in 64 percent ($n = 30$) of reported patients, of which 30% had hemoptysis ($n = 14$).¹²

In New York State, exclusive of New York City, deaths from TB appear to be relatively rare events. In 2001, of the 415 TB cases reported, 9 were identified at death. There are a number of reasons why TB cases are "missed" and are identified and reported at death. Individuals may have had a concurrent condition masking TB disease; they may have been treated for TB disease or infection in the past and suffered an unidentified reactivation; or they may have encountered economic or sociocultural barriers to accessing health care.

A TB-related sudden death, where TB disease was not suspected or detected until autopsy, led to a large contact investigation and prompted the New York State Department of Health to look into other TB deaths in an effort to identify patterns where TB disease may have gone undetected and to identify opportunities for intervention to prevent transmission of infection and subsequent development of disease. Some of the results of this investigation were previously reported as an abstract.¹³

BACKGROUND

At a large resort hotel (550 employees providing service to 600 guest rooms and a food service capacity of 1,000 guests/sitting), the security officer was on routine patrol when she was notified by radio of an individual lying on the hallway floor of one of the buildings where resort employees reside. On arrival, the officer found a man lying on his back, not breathing and without a pulse. One officer observed blood on the walls and floor of the hallway. There were no obvious signs of violence. The local rescue unit and the state police were summoned. The officer started cardiopulmonary resuscitation (CPR), and the others cordoned off the area. The patient was transported by ambulance to the hospital, and the officers secured the area as a crime scene until notified by the hospital, 3 hours later, that the man had died from natural causes. The officers cleaned the area with bleach and a biohazard clean-up kit, and the man's room was padlocked.

Because the death was unattended, the hospital conducted an autopsy. The cause of death was de-

termined to be cardiorespiratory failure caused by or as a consequence of TB, and the County Health Department was immediately notified. The case had never received medical attention for TB and was unknown to the county staff. The postmortem examination of lung tissue identified *Mycobacterium tb* complex, which was susceptible to all first-line drugs, e.g., rifampin, isoniazid, pyrazinamide, ethambutol, and streptomycin. A contact investigation was launched immediately.

County staff contacted the manager of the resort to report a TB death in one of the resort staff and explained both the need to conduct, and the logistics of, a contact investigation. The resort management worked closely with the county nurses to be sure that complete and accurate information was available for the investigation. The resort is located in a sparsely populated area north of New York City. Service worker staff for resorts of this type frequently have ties to New York City and travel to area resorts for seasonal jobs. These employees often live in housing available right on the resort grounds and include a high proportion of foreign-born individuals who often are not fluent in English. Foreign-born staff in this investigation came from 17 countries outside the United States, many of which were Central or South America; however, other countries of origin included China, former Soviet Union, and Indonesia. Language barriers were addressed through existing staff at the local health unit and the use of commercially available telephone-based translating services.

Management of the resort recognized the importance of the contact investigation and provided all necessary work schedules and assignments to facilitate identification of staff who may have been exposed to the patient. Transportation to the county clinic proved to be a barrier to attendance despite the provision of shuttles by the resort, so additional clinic sessions were held on the grounds of the resort at a location not accessible to the guests.

RESULTS

The initial investigation focused on individuals one would consider to be close contacts, i.e., those sharing living quarters, individuals working in close proximity with the patient, and friends with whom the patient spent time in social settings.

The local newspaper ran several stories about the death at the resort, which generated substantial interest in being tested among resort employees who had little or no contact with the patient. The county elected to test all individuals who requested

the test; however, for purposes of the contact investigation, data were segregated into categories of "close" and "not close."

The index case was a 60-year-old black Hispanic man born in Central America. His date of entry into the United States and immigration status is unknown. In May 1998, he started work at the hotel as a dishwasher. His residence was on the grounds of the resort. The building contained 4 single-room units, each approximately 10 feet × 10 feet and containing a sink. There was a common hall and shared bathroom for the residents.

The patient's medical history was incomplete. There was no known history of TB. A few weeks before his death he had been seen by a local physician and treated for an upper respiratory infection. Symptomatology indicative of TB could not reliably be documented; however, his associates reported a history of frequent coughing. The autopsy identified ½ -inch cavitory necrotic lesions in the upper lobe of each lung containing purulent yellowish-green material. Multiple well-circumscribed, soft, yellowish-white nodules were present ranging in diameter up to ½ inch, and the tracheobronchial and arterial tree was unremarkable. Microscopically, the sections taken from each lung showed extensive caseating granulomatous inflammation, and scattered acid-fast bacilli were identified. A direct acid-fast bacilli smear was graded 4+ and identified as *Mycobacterium tb* complex.

All food service activities took place in 1 large, poorly ventilated area; food was cooked, wait staff picked up plates to be served, bus staff returned soiled plates, and dishes were washed and stacked. The dishwashing station was at the end of the room where a large floor standing fan was positioned to ventilate the area by pushing air back into the center of the room. The patient worked long hours, often worked overtime, and had worked at his dishwashing job the day before he died.

The contact investigation included 264 individuals, 171 of whom were determined to be close contacts, and the remaining 93 were determined not to be close contacts. Given the attention raised by the local media around the case, the County Health Department agreed to test the not-close contacts, but their primary attention was focused on those contacts determined to be close. Close and not-close contacts differed remarkably by place of birth: 71% of the close contacts were born outside of the United States compared with 18% of the not-close contacts. Not-close contacts were also notably younger than close contacts. The large number of close contacts included food service staff from sev-

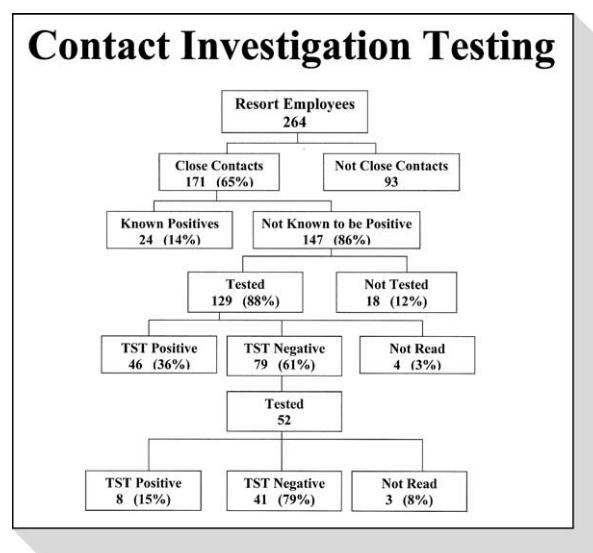


Fig. 1 Contact Investigations Summary Flowchart.

eral shifts and friends working at the resort. First-round testing of close contacts looked at 171 individuals, 24 (14%) of whom were known by the local health department to be TB skin test (TST)-positive. They were not tested but were interviewed for signs and symptoms and told to return if indications of TB developed. Of the 147 close contacts not known to be positive, 129 (88%) were tested in the first round. Positive PPD (purified protein derivative of *Mycobacterium tb*) results (≥ 5 mm) were seen in 46 (36%) of those tested (of the 46, 38 were foreign-born), 79 (61%) were negative, and 4 failed to return for the reading. Second-round testing included 52 of the 79 first-round negative individuals. Positive reactions were identified in 8 (15%), bringing the total number of TST-positive individuals to 54 (32%) those identified as close contacts (Figure 1). Among the not-close contacts, 89 were tested; 8 (9%) were positive, and 81 (91%) were TST-negative on first-round testing. Only 2 of those people presented for second-round testing, and 1 of these tested positively.

Treatment for latent infection

All PPD-positive individuals were interviewed by a public health nurse, evaluated by a physician, had an aspartate aminotransferase study if > 35 years or reported a history of liver problems, had chest x-rays taken, and were offered HIV testing. Chest x-ray results did not identify any current cases of TB, and of 27 individuals accepting HIV testing, no positive results were identified. Individuals with latent TB infection were prescribed 6 months of isoniazid treatment (the recommended regimen at the time).

Fifty-four individuals were recommended for treatment, and 46 accepted and started the medication. Twenty contacts (43%) completed at least 6 months of isoniazid treatment for latent infection; 4 individuals stopped therapy because of increased enzymes or severe symptoms; and the remaining individuals were lost to follow-up.

DISCUSSION

During 2002, foreign-born individuals accounted for 63% of the reported TB morbidity in New York State exclusive of New York City. In the investigation described here, the index patient was identified at death as having extensive TB disease and likely infected a substantial number of coworkers and social contacts. Individuals born outside of the United States in countries where there is a high prevalence of TB are at risk for developing active TB after immigrating to this country. Follow-up of these individuals can be challenging because of their fear of interaction with government agencies, lack of access to health care, cultural beliefs and practices, and language barriers, etc.

This rather large contact investigation yielded 54 individuals not previously known to be PPD positive. Interpretation of this number is complicated by 2 factors. Among the close contacts there was a high proportion of foreign-born individuals (71%). Many of those people were from high-prevalence countries in Central and South America.¹⁴ The second complicating factor is that the index patient had advanced TB. Given the advanced stage of disease and his history of frequent coughing, the patient may have been capable of transmitting infection for quite some time. Therefore, although some of the first-round TST-positive individuals may have been infected before coming into contact with the patient, others may have been infected by the patient months earlier and had already converted their skin test at the time of first-round testing.

In the second round of testing, 8 individuals were documented to have converted their skin test. Exposure to the index patient as the cause of their conversion is a viable hypothesis. Although the index patient in this investigation had a rather dramatic presentation that led to the diagnosis of TB, this incident does raise questions about missed opportunities to identify TB and the public and personal health implications for "missing" these patients earlier in their disease course.

The death of the resort employee from TB prompted a review of the State Tuberculosis Registry (exclusive of New York City) to identify any other

individuals in whom TB was detected at death. Eight other TB cases were identified at death in 2001. The 8 other cases accounted for 72 contacts investigated and 1 reported occurrence of latent TB infection. The 8 other cases were remarkable in that they were all born in the United States (compared with 2001 case load > 60 percent foreign-born), 7 were male, 7 were white, none were Hispanic, and the median age was 60 years (range of 45 to 76). One patient was known to be resistant to isoniazid and rifampin.

Despite the fact that TB has reached record low case counts in the United States, people are still dying of and with TB disease.

The combination of public health programs and careful clinical management during the past 10 years have significantly decreased the number of newly reported TB cases. Tuberculosis has not gone away. Some people still die of TB and completely bypass detection until a postmortem examination. Other TB patients are identified but still die from the disease alone or in conjunction with comorbid conditions. As national attention is drawn to anthrax, smallpox, and severe acute respiratory syndrome, TB cannot be ignored because it is still an important personal and public concern. The epidemiology of TB may have changed with shifting immigration patterns and the impact of HIV-related diseases. However, older, nonminority individuals are still dying from TB, and although fatalities may be comparatively rare events, TB should be considered in a differential diagnosis of patients with the characteristics previously described.

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