Outbreak of Tuberculosis in a Homeless Men’s Shelter

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Abstract: This case—tuberculosis in a homeless men’s shelter—is one of a series of teaching cases in the Case-Based Series in Population-Oriented Prevention (C-POP). It has been developed for use in medical school and residency prevention curricula. The complete set of cases is presented in this supplement to the American Journal of Preventive Medicine.

Tuberculosis presents a significant public health challenge. In this teaching case, medical students are given information about four cases of active tuberculosis that occurred over a short period of time in residents of a homeless men’s shelter. The students then walk through the steps that a local health department takes to identify and screen those individuals at risk for transmission of tuberculosis during an outbreak. During this process, they learn skills in epidemiology (such as defining “epidemic” and distinguishing uses for incidence and prevalence) as well as in population-based prevention of tuberculosis. Finally students discuss health policy as it relates to the control and prevention of tuberculosis. (Am J Prev Med 2003;24(4S):124–127) © 2003 American Journal of Preventive Medicine

Recommended Reading:

- Chapter in an epidemiology text that addresses measuring disease occurrence.

Objectives: At the end of the case, the student will be able to:

- apply the agent–host–environment model in understanding disease causation;
- define epidemic;
- identify common factors in incident cases;
- identify risk factors for tuberculosis (TB), including the TB and human immunodeficiency virus (HIV) connection;
- evaluate methods for population-based prevention, including contact investigations or other interventions (legal);
- develop skills in outreach follow-up in a hard-to-reach group; and
- formulate public health policies about TB.

Section A
Illness in Residents of Homeless Shelters

Teaching Note: Students should complete Section A before class.

It is August 1997 and you are a public health official for a county health department. It has been brought to your attention that four residents of homeless shelters in your county have recently been diagnosed with active TB. You are given the following information:

1. AJ is a 28-year-old male resident of the Oxford Street Inn/Rescue Mission who presented to SUNY–Upstate Emergency Department on July 17 with a 3-week history of productive cough and night sweats.
2. RC is a 36-year-old male resident of the Oxford Street Inn who presented to the Community Health Center on July 24 with a several-day history of productive cough and fever.
3. LF is a 43-year-old male resident of the Oxford Street Inn/Rescue Mission who presented to St. Joseph’s Hospital on July 29 with a 2-week history of productive cough with hemoptysis.
4. SW is a 47-year-old male resident of the Oxford Street Inn who presented to the Community Health Center on August 15 with a several-month history of severe cough and weight loss.

Question 1. What else would you like to know about these men?

Question 2. What are risk factors for latent tuberculosis infection (LTBI)? For active TB? (Consider the agent–host–environment model.)
Question 3. Is this an epidemic?

Section B
Investigation of an Outbreak

In Section A, you were asked whether this was an epidemic. To determine if this occurrence was markedly different from baseline, you need to know what the incidence of active TB is in your county.

Question 1. “Incidence” and “prevalence” are measures of disease occurrence. Which would you use to measure active TB? Which would you use to measure LTBI? Why?

Characteristics of the four patients described in Section A are presented in Table 1.

Question 2. What common factors are evident here?

Question 3. Three of the cases had negative tuberculin skin tests (TSTs). What are some of the limitations of using TSTs?

Question 4. Three of the initial cases were HIV positive. Describe the association between TB and HIV. Should testing and treatment for TB differ for individuals with HIV?

Question 5. How were you, the local public health officer, notified of these cases of TB?

Question 6. What entities are mandated to report selected communicable diseases?

Information obtained during the initial investigation of the four cases indicated that SW, the fourth person diagnosed with active TB, was likely the source case. He was found to have had symptoms consistent with active TB since January 1997, but he had refused medical attention at that time. He was a longtime resident of the Oxford Inn who stayed at the shelter every night in 1997 until he was hospitalized. His medical history revealed that he was diagnosed with TB in 1991 and had reportedly completed a course of self-administered therapy at that time.

Question 7. Now that all four cases have been reported, you need to decide whether intervention is necessary. How do you make the decision to intervene? What types of interventions do you recommend?

Question 8. Because active TB is recognized, contact investigations are initiated immediately.

A. Why?

B. Who is the target population (Oxford Street Inn versus all homeless shelters versus community at large)?

C. What method of screening would you recommend (TST, clinical assessment, or chest x-ray)?

Staff members at the county health department (CHD) and Oxford Street Inn were able to compile a master list of individuals who were at risk of TB infection based on dates of possible exposure (January 1997 to September 1997). A total of 312 individuals was determined to be at risk, including staff members at the shelter.

Question 9. The list of individuals at risk consisted almost exclusively of other homeless men who stayed at the shelters during this time period.

A. What factors need to be taken into account when considering contact investigations in this target population?

B. What strategies would you recommend to locate the persons identified as being at risk?

The staff members at both the Oxford Inn and at the CHD worked diligently to identify and locate these individuals. On the basis of knowledge of the individuals, men were classified by the ease at which they could be located and assessed for intervention. Table 2 demonstrates the results of the staff’s efforts.

Screening

All individuals who were determined to be at risk for TB were offered screening, including an initial TST, 3-month follow-up TST for those with an initial negative TST, chest x-ray, and clinical assessment. Not all men were found nor did all comply with recommendations. Figure 1 illustrates the results of the screening effort.

Through the above screening efforts, one additional case of active pulmonary TB was identified by the end of September 1997. Unfortunately, of the first five cases, four individuals did not voluntarily comply with

Table 1. Characteristics of the four men diagnosed with active tuberculosis

<table>
<thead>
<tr>
<th>Case</th>
<th>TST</th>
<th>Chest X-Ray</th>
<th>HIV status</th>
<th>Alcohol use</th>
<th>Substance abuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 × 0</td>
<td>Left upper lobe infiltrate</td>
<td>Positive</td>
<td>Past Hx</td>
<td>Past Hx</td>
</tr>
<tr>
<td>2</td>
<td>0 × 0</td>
<td>Right middle lobe opacity</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>0 × 0</td>
<td>Left lower lobe opacity</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>15 × 22</td>
<td>Severe bilateral disease with cavities</td>
<td>Negative</td>
<td>Past Hx</td>
<td>Past Hx</td>
</tr>
</tbody>
</table>

TST, tuberculin skin test; HIV, human immunodeficiency virus; Hx, history.

Table 2. Classification of homeless men based on accessibility, Oxford Inn Outbreak, Syracuse NY, 1997

<table>
<thead>
<tr>
<th>Patient category</th>
<th>Accessibility</th>
<th>Number (%) of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Medium to high</td>
<td>87 (28%)</td>
</tr>
<tr>
<td>B</td>
<td>Low</td>
<td>78 (25%)</td>
</tr>
<tr>
<td>C</td>
<td>Very low</td>
<td>147 (47%)</td>
</tr>
<tr>
<td>Total (A + B + C)</td>
<td></td>
<td>312 (100%)</td>
</tr>
</tbody>
</table>
recommendations for isolation and treatment. Court orders were issued in all four of these situations to enforce compliance. Please refer to Table 3 for a line listing of the five patients.

Question 10. Please discuss issues of individual autonomy versus community protection. When would you resort to obtaining a court order? Are there any other diseases for which you would recommend similar legal action?

Section C
Directly Observed Therapy and Case Management

Directly observed therapy (DOT) with case management is recommended by the Centers for Disease Control and Prevention for all people who have active TB as well as for certain individuals with LTBI. People who are infected with TB and who are at greater risk of progressing to active TB (such as children) may be evaluated for need for DOT for LTBI. Additionally, individuals who are at high risk of noncompliance with self-administered medication should be assessed for DOT. Because of the accessibility issues and concerns of noncompliance in the population of individuals at risk in this outbreak, DOT was recommended for all shelter residents diagnosed with LTBI. Figure 2 illustrates the disposition of the men identified as being at risk during the contact investigation.

Figure 1. Results of screening TST. Results are from the Oxford Street Inn outbreak, Syracuse, New York, 1997. TST, tuberculin screening test

Notes: Prior (+) TST, men who had documentation of a positive TST prior to January 1997; possible converter, men who were found to have a positive TST at the time of screening but whose prior TST status was unknown; documented converter, men who had documentation of a negative TST in the recent past but who were shown to be TST positive during this screening.

Figure 2. Disposition of 312 homeless men from the Oxford Street Inn outbreak, Syracuse, New York, 1997. TST, tuberculin screening test; DOT, directly observed therapy.

Question 1. Why was DOT important in this situation?
Question 2. What were significant barriers in administering DOT?
Question 3. How would you manage those individuals who refused DOT?

Section D
Aftermath of the Outbreak

Unfortunately, even though DOT was ordered for almost 90 men, very few individuals actually completed therapy for the same reasons that were explored earlier in the case. Over the following year, five more homeless men were diagnosed with active TB for a total of ten cases of active TB in homeless men in approximately 1 year. DNA fingerprinting demonstrated that seven of the cases were caused by an identical strain of Mycobacterium tuberculosis. An isolate from an eighth case was closely related and was felt to be a variant of the same strain. Isolates from two other cases were considered to be not related. Four of these ten patients had had a prior positive TST and had initiated therapy in the past, but none was known to have completed a full course of therapy.

Question. What public health policies would you recommend to address the above-described situation?

Table 3. Line listing for first five men diagnosed with active tuberculosis in homeless shelters in Syracuse, New York, 1997

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Date of diagnosis</th>
<th>Shelter</th>
<th>HIV status</th>
<th>Alcohol use</th>
<th>Substance use</th>
<th>Court order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
<td>7/97</td>
<td>Oxford/RM</td>
<td>Positive</td>
<td>Past Hx</td>
<td>Past Hx</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>7/97</td>
<td>Oxford/RM</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>8/97</td>
<td>Oxford</td>
<td>Positive</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>8/97</td>
<td>Oxford</td>
<td>Negative</td>
<td>Past Hx</td>
<td>Past Hx</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>9/97</td>
<td>Oxford</td>
<td>Negative</td>
<td>Yes</td>
<td>Unknown</td>
<td>Yes</td>
</tr>
</tbody>
</table>

RM, Rescue Mission; Hx, history.
Final Outcome of the Outbreak to Date

According to the New York State Department of Health, since 1997, there have been 109 cases of active TB reported in Onondaga County to date. Of these, 23 cases with positive cultures were evaluated for a linkage with the Oxford Street Inn. DNA fingerprinting has demonstrated that 20 of these cases were associated with the initial outbreak in the Oxford Street Inn. In addition, the New York State Department of Health reports that the same strain of *M. tuberculosis* has been found in at least 26 homeless individuals in Maryland and the District of Columbia.

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