Nemesis Revisited: Tuberculosis Infection in a New York City Men's Shelter

ABSTRACT

In November 1990, a screening was conducted to determine the point prevalence of tuberculosis infection in a volunteer sample of homeless men (n = 161) living in a congregate shelter in New York City. Of those for whom we have results (n = 134), 79% were positive for tuberculosis. The mean length of shelter stay from date of shelter entry was 31.8 months and was significantly associated with the tuberculosis infection rate. The findings suggest that crowded living conditions and the presence of a stable resident pool in crowded congregate shelters may be associated with transmission of tuberculosis infection. (*Am J Public Health.* 1993;83: 1743–1745

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Introduction

Nationally, the number of new cases of tuberculosis increased by 5% in 1989 and by 10% in 1990. The increase has been largely among 25- to 44-year-old men. This demographic finding coincides with—although it is not necessarily causally related to—the epidemic of acquired immunodeficiency syndrome (AIDS) and the increase in homelessness. In New York City alone, 3520 new tuberculosis cases were reported in 1990, representing a 38% increase over the number of new cases in 1989. This incidence level in New York City constitutes approximately 15% of all US cases reported in 1990.[1]

The prevalence of asymptomatic tuberculosis infection among the homeless has been reported to be as high as 22% to 50%.[2,3] In an immunocompetent population, it is estimated that only 25% of those exposed to tuberculosis become infected and that 10% of this subgroup go on to develop clinical disease.[4] However, the homeless are at greater risk for immune suppression because of poor nutrition, inadequate rest, and intercurrent medical illness. Among homeless men, 15% to 25% have also been found to have a lifetime history of a psychotic disorder, and a majority have histories of serious substance use.[5]

In this paper, we report on the prevalence of tuberculosis infection and selected risk factors for infection in a volunteer sample (n = 161) of homeless men who reside in a large congregate shelter (n = 660). We were particularly interested in exploring whether there might be a significant association between the length of stay in the shelter system and the development of tuberculosis infection, given that contagious spread is facilitated by living in overcrowded quarters.[6–8]

Methods

The Fort Washington Men's Shelter is located within a large armory administered by New York City's Human Resources Administration. The Shelter Medical Clinic, operated by Harlem Hospital Center, conducted the screening with the cooperation of the Harlem Hospital AIDS Treatment Group and the New York City Department of Health.

Approximately 660 men on a given night sleep in this shelter (see photo). Beds are separated by approximately 18 to 20 inches and are arranged on a large open floor measuring 55 000 square feet.

The drill floor (sleeping area) was selected as the screening site. Coffee and a snack were offered as an incentive for participation. Notices were posted throughout the shelter several days before the screening, and caseworkers who were in frequent contact with the men were encouraged to refer them to the screening. On November 26, 1990, 161 men volunteered and were evaluated for tuberculosis infection. Brief semistructured interviews were conducted. The date of the first shelter stay, which is entered into the Shelter Care Information Management System and signifies the date an individual was officially registered by a caseworker anywhere in the New York City shelter system, was used to approximate length of shelter stay.

A self-reported history of tuberculosis or a positive skin test in similar populations has been found to represent a valid assessment of tuberculosis status.[9–12] Therefore, all residents who did not have either a history of tubercu-

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Fort Washington men's shelter, drill floor, New York, NY, 1990. ©1990 Patrick Ashley.

TABLE 1—History of Tuberculosis and Skin Test Reactions among Homeless Men in a New York City Shelter, 1990, by Age and Ethnicity (n = 134)[a]

	PPD Negative (n = 29)		PPD Positive by History (n = 33)		PPD Positive (n = 72)	
	n	%	n	%	n	%
Ethnicity						
African-American	22	75.9	22	66.7	60	83.3
Hispanic	7	24.1	11	33.3	12	16.7
Age, y						
20–29	9	31.0	9	27.3	27	37.5
30–39	16	55.2	15	45.4	25	34.7
40–49	4	13.8	6	18.2	14	19.4
50–61	0	0.0	3	9.1	6	8.3

Note. PPD = purified protein derivative.
[a]Excludes those who did not return for a reading (n = 24) or who were anergic (n = 3).

losis or a reactive skin test received (Aplisol) 5 tuberculin (0.1 mL) units of purified protein derivative injected intradermally in the volar aspect of the right forearm. Each resident also received anergy testing with 0.1 mL of 1:1000 strength Candida (in the left forearm). All tests were read within 48 to 96 hours and interpreted according to the American Thoracic Society's recommendations.[13] According to recommendations of the Centers for Disease Control and Prevention (CDC), a purified protein derivative reaction of 10 mm or greater of induration and a Candida reaction of greater than 2 mm of induration were interpreted as positive. Reactions of less than 10 mm were not recorded.

Results

Slightly more than three-fourths (77%) of the total sample (n = 161) identified themselves as African-American, 22% were Hispanic, and one respondent did not reveal his ethnicity. The mean age of the sample was 34.5 (SD = 8.6; range = 20 to 61 years). The mean length of time from date of shelter entry was found to be 31.8 months (SD = 18.6). Time since date of entry into the shelter system ranged from 0 months (2 weeks or less) to 8 years; the median was 29 months. Sixty-four percent of the total sample were defined as long-term users of the New York City shelter system, the criterion being a date of first shelter stay of more than 2 years ago.

TABLE 2—Risk of Tuberculosis Infection among Homeless Men in a New York City Shelter, 1990, by Age, Ethnicity, and Length of Shelter Stay

Predictor	Adjusted Odds Ratio[a]	95% Confidence Interval
Age, y	1.04	0.99, 1.11
African-American vs Hispanic	1.11	0.40, 3.13
Time from date of shelter entry, mo	1.02	1.00, 1.05

[a]Based on results of logistic regression model and adjusted for the other variables in the table.

TABLE 3—Predicted Probability of Tuberculosis Infection among Homeless Men in a New York City Shelter, 1990, by Time from Date of Shelter Entry[a]

	Months					
	0	6	12	18	24	36
Probability	.10	.12	.14	.16	.18	.24

[a]Based on results of logistic regression model.

Those men who were purified protein derivative positive by history and therefore were not tested at the screening represented 21% (n = 33) of the sample (see Table 1). One hundred twenty-eight participants were tested and 81.3% (n = 104) returned for a reading. Of those who returned, 69% (n = 72) were positive; three men failed to react to both purified protein derivative and Candida control. The mean induration value in millimeters for those who returned and tested positive was 18.8 (SD = 4.9, range 10 to 30). The breakdown in 5-mm increments was as follows: 10 to 14 mm: 16%; 15 to 19 mm: 35%; 20 to 24 mm: 35%; and 25 to 30 mm: 14%; only 21% were purified protein derivative negative.

The prevalence rate of any tuberculosis infection, including those participants with an induration of 10 mm or greater and those with past history, excluding the nonreturns, was 79%.

In a logistic regression predicting tuberculosis infection (based on past history or an induration of 10 mm or greater), time from date of entry into the shelter system was significantly associated ($P < .05$) with risk (Table 2). For example, control-

ling for age and ethnicity, the predicted probability of tuberculosis infection at 36 months from date of entry into the shelter system was .24 compared with only .14 at 12 months (Table 3).

Discussion

The most remarkable finding of this study was the extremely high prevalence, past or present, of tuberculosis infection (79%) among those who volunteered for screening. Also, it is notable that we, like others,[8] found that the length of shelter stay was significantly associated with the tuberculosis infection rate. These two findings support the proposition that crowded living conditions in congregate shelters are associated with the spread of tuberculosis infection.

Our study has some important limitations. First, the sample was self-selected and so potential selection bias was introduced. For example, caseworkers may have been more likely to refer medically ill clients to the screening or to have encouraged men at risk of tuberculosis infection (e.g., known intravenous drug users) to participate. However, we found no evidence of this bias.

Second, because an individual may not have stayed in the shelter continuously from entry date to date of screening, the length of shelter stay should be considered a proxy. Third, we had incomplete control of confounders, such as alcohol, drug use, and history of sexually transmitted disease and human immunodeficiency virus (HIV). Finally, only an induration of 10 mm or greater was interpreted as a positive test because, at the time of this screening, 10 mm was still what the CDC recommended for purified protein derivative test positivity in homeless individuals. Since the HIV status of the participants was unknown, 10 mm was used instead of 5 mm to capture all who would unquestionably be considered positive for purified protein derivative in this population. Given that this population is at high risk for HIV disease, one could speculate that the prevalence of purified protein derivative positivity was actually underrepresented since there may have been several men with an induration of between 5 and 9 mm. Based upon current CDC recommendations,[14] members of this group would be candidates for prophylaxis. Therefore, the rate of reported tuberculosis infection and implications for intervention may be even greater.

Local health departments can enable agencies to provide relatively safe tuberculosis-controlled living environments by mandating periodic tuberculosis screening and a follow-up chest x-ray and sputum analysis. Without an effective plan for follow-up, however, screening efforts will serve little purpose. Departments of Health must ensure that patients remain under medical supervision until treatment is completed. The recent epidemic of deaths due to multidrug-resistant tuberculosis strains reported in the New York metropolitan region[15] underscores the fatal consequences of episodic treatment of persons, especially those with immune deficiency. One might suspect that the costs of attempting to treat multidrug-resistant tuberculosis in terms of prolonged, recurrent hospitalization and possible surgery would far exceed those of using directly observed therapy, even with monetary incentives or the equivalent. However, for selected populations, especially among the disenfranchised, supervised therapy with incentives should be seriously considered. The eradication of tuberculosis will come about by social measures as well as by the development of better drugs and vaccines. □

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