Incidence of Tuberculosis Infection among New York State Prison Employees

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ABSTRACT

Objectives. This study examined tuberculosis skin test conversions among 24 487 New York State prison employees in 1992.

Methods. Conversions were analyzed by prison and by job category.

Results. The conversion rate was 1.9%. Employees in prisons with low and high numbers of prisoner cases had odds ratios for conversion of 1.67 (95% confidence interval [CI] = 1.27, 2.19) and 2.20 (95% CI = 1.69, 2.87), respectively, relative to employees in prisons with no prisoner cases. In prisons with cases, guards and medical personnel had odds ratios of 1.64 (95% CI = 1.11, 2.43) and 2.39 (95% CI = 1.40, 4.08), respectively, relative to employees with little prisoner contact.

Conclusions. In 1992, approximately one third of new infections among New York State prison employees were due to occupational exposure. (*Am J Public Health.* 1997;87:2012–2017)

Introduction

The incidence of active tuberculosis among New York State prison inmates increased from 15 per 100 000 in 1976 through 1978 to 139 per 100 000 in 1993.[1] The tuberculosis infection rate among inmates in the early 1990s was about 20%, while the human immunodeficiency virus (HIV) seroprevalence rate was about 13%.[1–3] In 1990/91, the average number of prisoners was 54 735; inmates were usually transferred between prisons several times a year.[4]

In 1991, a tuberculosis outbreak among prisoners resulted in transmission to prison employees,[5] motivating a mandatory tuberculin skin testing program for approximately 27 000 employees. Here we use the results of the first 2 years of testing to determine whether work in specific job categories and work in a prison with inmate cases were risk factors for converting from negative to positive on the skin test.

Methods

Baseline tuberculin skin testing (Mantoux test) was conducted on all employees of the New York Department of Corrections employed at the time the testing program began. Induration was measured by trained personnel within 48 to 72 hours. Workers were excluded from testing if they had a documented history of tuberculosis, a previous positive skin test, or immediate hypersensitivity to the antigen. Baseline skin testing was conducted from November 1, 1991, through March 1, 1992; second tests were done a year later. Two-step testing to detect boosting was not done. Computerized data on test results (negative or positive, less than 10 mm induration or 10 mm or more) and demographic variables were available. We studied 24 487 employees who (1) had two sequential tests, (2) were negative for the first test, and (3) had complete data for demographic covariates.

"Converters" were defined as those who converted from negative (less than 10 mm induration) to positive (10 mm induration or more) on their skin test. Conversion rates were calculated (1) according to whether an active inmate tuberculosis case had been present in the prison where an employee worked in 1992 and (2) by employee job category. These two "exposure" variables were used as indicators of the probability of employee contact with contagious prisoners. Analyses were conducted via a logistic model that included variables for age (10-year categories), sex, ethnicity (White, Black, Hispanic), and New York City residence, in addition to exposure variables. Attributable risks were calculated via standard formulas.[6]

Job categories included clerks, management, corrections officers (guards), social workers and teachers, medical personnel (full-time only), and maintenance workers. Those considered to have the least contact with prisoners (i.e., clerks, management, maintenance workers) served as the referent group.

Ninety inmates in state prisons were diagnosed with active tuberculosis in 1992. These individuals had passed through 43 of 69 prisons in the 12 weeks prior to their diagnosis (a presumed infectious period). These 43 prisons were classified into "low" and "high" categories according to whether they were above or below the median for the number of inmate cases divided by the number of prison employees. Classification of prisons by the number of 1992 inmate cases was only a rough indicator of risk for employees tested over a range of months in late 1991 and early 1992 (and again a year later); any resulting misclassification should have biased results toward the null.

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This paper was accepted February 7, 1997.

Records of induration size for the second year of testing were retained at prisons. To verify the validity of our second-year data, we reviewed data at all prisons with a baseline prevalence of 5% or greater and all prisons with more than 20 positive tests at baseline. We recorded the testing date and width of induration for tests in which the recorded induration was 10 mm or more and for a random sample of 10% of tests in which the induration was less than 10 mm. We then matched these data to our computerized data. Seven of 259 tests (2.7%) had been misclassified as negative or positive in the computerized data.

TABLE 1—Employee Incidence of Skin Test Conversion, by Number of Cases among Inmates at Work Site in 1992

Inmate cases in 1992[a]	Second Test Positive[b]	Second Test Negative	Incidence of Conversion, %
No known	85	5 890	1.4
Low (less than median)	169	10 104	1.7
High (greater than median)	212	8 027	2.6
Total	466	24 021	1.9

[a]An inmate diagnosed in 1992 could have passed through more than one prison in the 12-week period prior to diagnosis. The number of inmates in the prison with active tuberculosis was divided by the number of prison employees to obtain a rough index of the probability that an employee would come into contact with an inmate with active tuberculosis.
[b]All employees tested negative on their first baseline test.

Results

Employees had a mean age of 40 years and a mean of 10 years' employment. Eighty percent were male, 88% were White, and 5% lived in New York City. There were 466 conversions among 24 487 employees (1.9% incidence) during 1992. Employees who converted were significantly more likely to be older and non-White and to live in New York City.

Table 1 shows a positive trend in unadjusted incidence by exposure in prisons with no (known) inmate cases, a low number of cases, or a high number of cases in 1992. After adjustment for age, sex, race, and New York City residence, the odds ratios of skin test conversion by prisons with no cases, a high number of cases, and a low number of cases were 1.00, 1.66 (95% confidence interval [CI] = 1.27, 2.10), and 2.20 (95% CI = 1.69, 2.96), respectively.

Table 2 shows the adjusted results by job category. In prisons with no known inmate cases, there were no significant differences between job categories. In prisons with inmate cases, however, both corrections officers and medical personnel had significantly increased risks relative to the referent group.

TABLE 2—Adjusted Odds Ratios for Employees Testing Positive on Second Test, by Job Category and Presence or Absence of Inmate Cases in 1992

	Odds Ratio (95% Confidence Interval)	
	Prisons with No Known Inmate Cases in 1992 (n = 26)	Prisons with Inmate Cases in 1992 (n = 43)
Corrections officers vs referents	0.82 (0.45, 1.50)	1.63 (1.10, 2.42)
Medical personnel vs referents	0.88 (0.29, 2.69)	2.37 (1.39, 4.04)
Social workers vs referents	0.48 (0.20, 1.19)	0.95 (0.57, 1.56)

Note. The logistic regression model for employees working in prisons without cases included variables for age, sex, ethnicity (White, Black, Hispanic), and residence in New York City. All employees tested negative on their first baseline test. The reference category was maintenance and clerical employees.

Discussion

This study is the first prospective investigation of tuberculosis infection among prison employees. Other studies have been contact investigations seeking to identify recent close contacts with an index patient, so as to determine who had been infected. Such investigations have the advantage of a good definition of exposure, and they serve to identify infected persons for public health purposes. On the other hand, prospective studies of all prison employees have the advantages of covering the entire population potentially at risk, of considering all inmate cases simultaneously as potential sources of infection, and of permitting the calculation of incidence rates and attributable risks by potential exposure category.

Our data suggest that approximately 33% of new infections in 1992 among New York State prison employees were due to occupational exposure. Among medical personnel and guards working in prisons that had inmate cases, 58% and 39% of new infections in 1992 were attributable to occupational exposure, respectively.

Continued mandatory testing of prison employees is warranted. Suggested improvements in the program include two-step testing, recording of size of induration in the centralized database, and use of a structured interview with those testing positive to elicit contact sources.

Occupational infection with tuberculosis in New York State prisons was probably at its peak in 1992, the first year of testing employees. The tuberculosis incidence rate (oral communication, New York Department of Corrections, January 1997) and the HIV seroprevalence[3,7] rate among prisoners each dropped approximately 40% from 1992 to 1995. These trends should have resulted in a considerable decrease in occupational exposure. □

Acknowledgments

Yvonne Boudreau, Patricia Simone, Stephen Markowitz, and Demtria Collia kindly provided comments on the manuscript.

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Compliance with Tuberculosis Drug Regimens: Incentives and Enablers Offered by Public Health Departments

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ABSTRACT

Objectives. This research examined incentives implemented by public health departments to encourage tuberculosis patients to comply with tuberculosis drug regimens.

Methods. A questionnaire addressing incentives was mailed to the directors of each state's health department during May 1995. All 50 states and the District of Columbia returned questionnaires.

Results. The survey results indicate that public health departments in almost all states are implementing the incentives advocated by tuberculosis experts.

Conclusions. The implementation of these incentives may help to explain why the incidence of tuberculosis resumed its long-term decline in the United States during 1993 after a decade of resurgence. (*Am J Public Health.* 1997;87:2014–2017)

Introduction

From 1952 to 1985, the annual incidence of tuberculosis in the United States fell from 56 cases to 9 cases per 100 000 population, or about a 5% decrease per year.[1] The consistent annual decline of the incidence of tuberculosis in the United States ended in the mid-1980s, increasing from 9.1 tuberculosis cases per 100 000 population in 1988 to 10.5 cases per 100 000 population in 1992.[2] This trend of increasing incidence was reversed in 1993, with the annual incidence of tuberculosis falling to 9.8 cases per 100 000 population that year and to 9.4 cases in 1994.[3] The resurgence of tuberculosis in the late 1980s and early 1990s underscores the importance of developing and implementing effective approaches to control and treat this communicable disease. This paper describes the incentives and enablers implemented by state and local health departments in each of the 50 states and the District of Columbia to encourage tuberculosis patients to comply with tuberculosis drug regimens.

Methodology

As a means of identifying incentives and enablers, a questionnaire was mailed to the directors of the state health departments in each state and the District of Columbia during May 1995. (In almost all cases, the questionnaires were completed and returned by administrators of the states' tuberculosis control programs.) By August 1995, all 50 states and the District of Columbia had returned completed questionnaires. The questionnaire provided the following list of incentives and enablers and requested that respondents circle any that apply: free meals, free clothing, free transportation to treatment, cash (if yes, the amount), and "other effective incentives (please describe)."

Tables summarizing the results of the survey were mailed to the health departments for verification and updates in October 1995.

Treatment Incentives and Enablers

An ad hoc committee of the Scientific Assembly on Microbiology Tuberculosis and Pulmonary Infections has suggested that the use of incentives and enablers can help encourage tuberculosis patients to comply with tuberculosis drug regimens.[4] Among the incentives identified as successful are food and clothing, with bus tokens and babysitting services mentioned as enablers. Food

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This paper was accepted February 21, 1997.

Note. The conclusions presented in this paper are those of the author and do not necessarily reflect the views of the Health Care Financing Administration.