

Increased Incidence of the Outbreak Strain of *Mycobacterium tuberculosis* in the Surrounding Community after an Outbreak in a Jail

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Background: Between 1995 and 1997, a tuberculosis outbreak occurred in a large, urban jail. We investigated whether the outbreak strain of *Mycobacterium tuberculosis* (*M. tuberculosis*) was circulating in the surrounding community after that outbreak.

Methods: We performed a retrospective cohort study of people with tuberculosis in Shelby County, TN, from January 1998 through August 1999, with molecular fingerprinting of *M. tuberculosis* strains.

Results: From January 1998 through August 1999, 23% of cases in the community involved a strain of *M. tuberculosis* that was indistinguishable from the previous jail outbreak strain. Twelve people (63%) with that strain had no history of recent incarceration.

Conclusion: Two years after a tuberculosis outbreak in the jail, the outbreak strain was more prevalent in the surrounding community than it was during the jail outbreak. Jails can be important reservoirs of tuberculosis, which may subsequently circulate outside the institution. If efforts to eliminate tuberculosis are to be successful, the disease must be controlled successfully in such high-risk populations.

In 1999, 3.3% of all newly diagnosed cases of tuberculosis reported in the United States occurred in people who were residents of correctional facilities.¹ Incarcerated populations have high rates of substance abuse, human immunodeficiency virus infection, low socioeconomic status, and other risk factors for tuberculosis,^{2,3} and thus correctional facilities are

important reservoirs of infection.⁴⁻⁶ Many outbreaks of tuberculosis in prisons have been reported, and the transmission of tuberculosis from prisons to the surrounding community has been documented.⁷ In contrast to prisons, which house convicted inmates for long periods, jails are usually locally administered facilities that house inmates for shorter periods and can have high turnover rates. Few outbreaks of tuberculosis in jails have been reported.^{8,9} From 1995 through 1997, an outbreak of tuberculosis occurred in a large, urban jail.⁸ Active tuberculosis was diagnosed in 38 inmates and 5 guards. Nineteen (79%) of the 24 inmates with cultures positive for *Mycobacterium tuberculosis* (*M. tuberculosis*) had isolates with DNA fingerprints matching those of other inmates, and isolates from both guards who had positive cultures for *M. tuberculosis* matched the predominant strain found in the inmates. We investigated the possibility of dissemination of the outbreak strain of *M. tuberculosis* in the surrounding community after this outbreak.

Patients and Methods

DNA fingerprinting was performed for all available isolates of *M. tuberculosis* obtained from people with tuberculosis in Shelby County, TN, reported to the Department of Health during the 20-month period from January 1998 through August 1999. Isolates were fingerprinted at the Centers for Disease Control and Prevention by performing IS-6110 restriction fragment length polymorphism analysis.¹⁰ Finger-

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Key Points

- Jails can be important reservoirs of tuberculosis.
- Tuberculosis that originates in jails can spread outside the walls of the institution and affect the surrounding community.
- If national efforts to control tuberculosis are to be successful, attention must focus on controlling the disease in high-risk populations such as inmates in correctional facilities.

print patterns were compared with strain J, the distinctive 11-band pattern predominant among inmates during the tuberculosis outbreak in the jail between 1995 and 1997. Health department records of reported cases were reviewed, including contact investigation sheets, nursing and outreach worker records, and medical histories, which included data regarding incarceration. County jail records, which used fingerprinting to identify people who might use aliases, were cross-matched with the health department registry of people reported to have tuberculosis during the study period to determine whether they had ever been incarcerated in the local jail before being diagnosed.

Results

During the study period, 156 cases of tuberculosis were reported to the county health department. Of those, 128 were pulmonary, and 86 (55%) of the pulmonary cases had sputum cultures positive for *M. tuberculosis*. DNA fingerprinting was performed in 81 (94%) of the 86 isolates of *M. tuberculosis* obtained from patients diagnosed during the period of interest. These 81 isolates included 41 distinct DNA fingerprint patterns, 19 (23%) of which had a fingerprint pattern that was indistinguishable from that of the strain (ie, strain J) that had been predominant in the jail during the outbreak of 1995 through 1997. Two other clusters were identified, including 14 patients with an identical four-band pattern and 6 patients with a two-band restriction fragment length polymorphism pattern. No epidemiologic links were identified among patients in those clusters.

During the period of the tuberculosis outbreak in the jail between 1995 and 1997, 6 (14%) of 43 people in the community who had sputum cultures positive for *M. tuberculosis* and had DNA fingerprinting performed were determined to have tuberculosis strain J, and only 2 of those people did not have a history of incarceration in the jail. Although not statistically significant, the proportion of cases of tuberculosis in this community due to strain J increased from the period of the jail outbreak to the current study period (Table 1).

Among 156 people in the county with newly diagnosed tuberculosis, people with strain J were not statistically more likely to have been incarcerated than people with a different

strain. There was no known epidemiologic link between the 19 cases with strain J and people involved in the earlier outbreak in the jail. Among the 19 people with strain J isolated in 1998 and 1999, 12 (63%) had no history of incarceration in the jail in the 5 years before their diagnoses. Six of these people had never been incarcerated in the jail. The only epidemiologic link between the 19 people was one person with no history of incarceration who was known to have been in contact with a person with strain J who had a history of multiple incarcerations. One person in the community with strain J subsequently transmitted tuberculosis to a 2-year-old child who developed active disease.

Discussion

During a tuberculosis outbreak in a large, urban jail between 1995 and 1997, only 14% of people with tuberculosis in the surrounding community were infected with strain J (the strain of *M. tuberculosis* responsible for the jail outbreak), and two thirds of those community cases had a history of incarceration. From 1998 through 1999, after the outbreak was over and transmission within the jail had ceased, 23% of new tuberculosis cases within the county were due to the distinctive strain of *M. tuberculosis* implicated in the earlier jail outbreak. No direct link with the jail could be shown for a majority of these cases. Of note, strain J had never been identified in Tennessee before this jail outbreak, and it is not known to have been endemic in this region.

Because of the limited number of culture-confirmed community cases of tuberculosis in which DNA fingerprinting was performed, the increase in the proportion of cases due to strain J between these two periods was not statistically significant. Nonetheless, the lesson to be learned from this observation is important. Jails may play an important role in the epidemiology of tuberculosis in the surrounding community, serving as reservoirs of disease and potential accelerants of dissemination. One study indicated that 24% of the tuberculosis cases in a county were associated with its jail.⁹ Jail populations have a high prevalence of risk factors for a variety of communicable diseases, and crowded conditions in jails are conducive to the spread of tuberculosis within these institutions. Because of the high turnover rate of jail populations, the spread of tuberculosis from jails to the surrounding community is likely.

A variety of demographic factors affect the incidence of tuberculosis in a specific geographic area, including immigration, changes in the percentage of the population that is foreign-born, and transfer of prison inmates from one region to another. As the incidence of tuberculosis in the United States continues to decrease, correctional facilities are likely to remain one of the last bastions of endemic disease in the United States. Jails and prisons represent an important environment in which to break the cycle of the spread of this disease, both within the facilities and in the surrounding community.

Table 1. *Mycobacterium tuberculosis* strains identified by performing DNA fingerprinting in infected people in the community^a

Study period	No. infected with strain J (jail outbreak strain)	No. infected with different strains
1998–1999	19	62
1995–1997 (jail outbreak period)	6	37

^aRelative risk, 1.68; *P* = 0.2.

The occasional example of intrajail transmission of tuberculosis can be prevented in large measure by vigorous detection of active cases at jail admission.¹¹ In addition, the large pool of high-risk individuals in both jails and prisons presents a unique opportunity to arrange for the evaluation and treatment of latent tuberculosis infection. In prisons, an inmate with a latent infection is likely to be incarcerated long enough to complete a course of preventive therapy under close supervision, and many prison systems have procedures in place to facilitate this type of preventive measure.¹² The short stays and high turnover rates typical of jails present substantial additional barriers. Even if people infected with tuberculosis can be identified and educated while in jail, the completion of treatment for latent infection is likely to require successful referral to a local health department and provision of close follow-up. Effective models of community and correctional health care collaboration have been successful in following patients with human immunodeficiency virus infection and other sexually transmitted diseases,¹³ and similar programs likely need to be developed to ensure appropriate follow-up of people who need treatment for latent tuberculosis infection. Without such systems in place, a unique opportunity to intervene in the problem will be lost.

A substantial proportion of high-risk jail inmates are unlikely to receive adequate medical care in their communities, making it imperative that society take advantage of the opportunity to screen them thoroughly while they are in custody. Correctional institutions and health departments often do not have a record of close collaboration, but if tuberculosis is to be eliminated in the United States, that situation must change. As the data reported in this study demonstrate, problems that seem to be contained while they incubate within the walls of an institution can ultimately threaten the surrounding community. Recent recommendations have emphasized the importance of addressing tuberculosis control in correctional facilities as part of the larger battle to eliminate the disease.¹⁴ The public health system needs to work closely with correctional facilities to ensure adequate support for programs designed to diagnose and treat tuberculosis and to interrupt its transmission.

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