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Evaluation of identifying tuberculosis infection and disease in a rural institutionalized population

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Abstract

CONTEXT: Although the overall prevalence of tuberculosis (TB) in the United States is declining, correctional facilities continue to encounter a higher prevalence of this disease. Despite mandatory reporting laws for active TB, data for latent TB infection (LTBI) remains sketchy because reporting it is not required.

PURPOSE: Investigation of the period prevalence of LTBI in a rural Ohio regional jail compared with other populations in the region to determine the need and adequacy of the screening program.

METHODS: Data collected on inmates was compared with data collected on hospital employees within the same geographic region.

FINDINGS: Between January 2006 and July 2007, staff at the jail tested 1274 inmates for TB using the Mantoux purified protein derivative (PPD) method. Ten inmates (6 in 2006 and 4 in 2007) tested positive. All 10 cases were followed with a negative chest radiograph, leading to the diagnosis of LTBI. The overall incidence for the jail for LTBI was 0.8%, with 0% active cases. However, 85 inmates (6.7% of the population) were released before a PPD interpretation could be completed. In the comparative population, 651 hospital employees were tested for TB. Of these, 32 employees tested positive (LTBI prevalence of 4.9%). There were no cases of active TB reported.

CONCLUSION: The prevalence of LTBI in a rural jail (0.8%) is lower than the comparative sample population at a local hospital (4.9%). The rapid release of inmates (6.7%) indicates that TB data is incomplete and that potential cases of LTBI could have been unreported because of missed opportunity for interpretation of skin tests.

Tuberculosis is a worldwide pandemic.[1] According to the World Health Organization (WHO): "In 2005, the estimated per capita TB incidence was stable or falling in all six WHO regions. However, the slow decline in incidence rates per capita is offset by population growth. Consequently, the number of new cases arising each year is still increasing globally and in the WHO regions of Africa, the Eastern Mediterranean, and Southeast Asia."[2] As well, the WHO estimated that 1.6 million people worldwide died of TB in 2005, with a rate of 4400 deaths per day.[2]

In the United States, the rates of TB are declining. In 2007, the Centers for Disease Control and Prevention (CDC) reported a total of 13,299 TB cases (4.4 per 100,000 persons) in the United States, representing a 3.3% decline from the 2006 rate.[3] Despite decreasing TB rates in the general US population, incarcerated populations still have a

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high prevalence of active TB.[4] Jail inmates have an estimated TB rate 17 times higher than the baseline rate for the total US population.[5]

An inmate population is perhaps one of the hardest groups for which accurate health records can be kept, owing to the constant processing and release of prisoners.[4,6-8] Given that the vast majority of inmates return to the community, TB in correctional facilities represents a potential threat to public health.[9] In 1996, the CDC issued updated recommendations for the control of TB in correctional facilities. The guidelines focused on four key areas: (1) screening for TB, (2) containment of TB, (3) monitoring and evaluation, and (4) collaboration with correctional facilities and public health departments.[10]

Although trends for state and national TB statistics have been well documented by the Ohio Department of Health and the CDC, data for latent tuberculosis infection (LTBI) still remain a mystery. It has been documented that inmates of correctional facilities are at higher risk for LTBI than are members of the general population.[7] In addition, medical conditions such as LTBI and co-infection with HIV are more common in underserved populations (such as jails) than in the general population.[11] Because LTBI is an asymptomatic condition, it is hard to diagnose. The only means to discover whether a person has LTBI is through screening programs, as it has been mandated in the health care setting and in some correctional facilities and jails. The importance of documenting cases of LTBI is that these patients have a 1-in-10 chance of developing active TB in their lifetime if it is not treated.[2] If an inmate were to develop active TB while incarcerated, the public health repercussions in the jail could be devastating.

This study investigated the prevalence of LTBI in a rural Ohio regional jail. The data collected was compared with another population in the region that was considered at high risk to determine whether the prevalence of LTBI and TB are higher in this high-risk population. In addition, this study hopes to determine whether this screening for TB is efficacious enough to maintain funding for the screening program in the jail.

Methodology

Regional jail data source

Consecutive jail inmates at a rural Ohio regional jail, who entered the jail between January 2006 and July 2007, were included in the study. All inmates entering the jail were given TB skin tests (TST) with Mantoux PPD. For inmates still incarcerated, the TST was interpreted between 48 and 72 hours after PPD injection. Skin tests with results $\geq$10 mm in duration were considered positive (abnormal). Inmates with positive tests then underwent chest radiography to reveal whether they had any indication of active TB disease. Inmates were also observed for signs and symptoms of active TB such as persistent cough for longer than two weeks, hemoptysis, weight loss, chills, and/or night sweats, anorexia, and fever.

Inmates with positive test results had data recorded regarding their TST results, radiograph results, and gender; they were then categorized as having active TB or LTBI. Patients who were no longer in the jail for 48 to 72 hours did not have their TST interpretation and were identified as released (REL).

Regional comparative data

Because TST is not recommended for the general population and no data exists for the rates of LTBI in the general population, the investigators chose to examine other at-risk populations to compare with the jail data. These populations also had mandatory screening programs. The comparative population included employees of a hospital in the same geographic region. The hospital tests its employees annually because of a presumed increased risk for hospital employees' exposure to TB infection from patients. In 2006, this hospital's county represented the highest number of TB cases in Ohio's Southeast (Appalachian) region.[12] TSTs with induration of or greater than 10 mm were considered positive. Employees who tested positive were required to undergo a chest radiograph. If the radiographs were negative for TB, the employee was considered to have LTBI; if the radiograph was consistent with TB, the employee was considered to have active TB.

Results

The Ohio regional jail tested 1274 inmates for TB using the Mantoux PPD method between January 2006 and July 2007. Of those tested, 10 inmates (6 in 2006 and 4 in 2007) had positively interpreted TSTs. There was a 0.8% prevalence of those testing positive on the TST. Those testing positive with the TST had a chest radiograph ordered. All of these cases were followed with a negative chest radiograph, leading to the diagnosis of LTBI.

From this population, 6.7% (85) were lost to follow-up. One-thousand two-hundred seventy-four inmates were tested for TB, and 85 inmates (74 in 2006 and 11 in 2007) were released before the TST could be interpreted (Table 1). Among the hospital employees, 651 employees were tested for TB, and 32 employees tested positive (4.9%).

With regard to gender differences between the groups, more men (90.5%) than women (9.5%) were represented in the regional jail populations. This was reversed in the hospital employee population, where the females (77%) were predominant (males 23.0%). In the analysis of gender and TB infection, there were no statistically significant differences among the jail ($p = 0.281$) and the hospital employees ($p = 0.554$).

Table 1 Prevalence of LTBI in the jail versus hospital populations

	Jail		Hospital employees	
TB result	Frequency	Percent	Frequency	Percent
Positive	10	0.8	32	4.9
Negative	1179	92.5	619	95.1
Released	85	6.7		
Males	1151	90.5	501	77.0
Females	121	9.5	150	23.0
TOTAL	1274	100	651	100

Comments

First, the results demonstrate that the period prevalence of LTBI in the rural Ohio regional jail was lower than that of comparable populations of the region. The rural hospital employees had dramatically higher rates (4.9%) of LTBI. As mentioned previously, no cases of active TB disease were found in any of the study populations. There may be several explanations for these results.

It is possible that the comparator population had an abnormally high rate of LTBI. However, because no national database or national trends exist, we cannot substantiate this supposition. This study limitation occurred because no other sample population in the region with similar TB testing could be compared with the inmate population.

Second, and perhaps most significantly, the comparator populations did not lose a substantial number of tested individuals to follow-up. If all of the people lost to follow-up had LTBI, the rate comparisons would differ greatly. It is widely recognized, however, that the TST is often an impractical screening tool in short-term correctional facilities, because of inmates being transferred or released before the skin tests can be interpreted.[9] It has been suggested that other screening tools may be more useful and efficient in testing this population; these tools include chest radiograph and QuantiFERON (Cellestis Ltd., Victoria, Australia), a 24-hour blood test that specifically identifies antibodies to *Mycobacterium tuberculosis*.[9] However, because of the expense, many institutions may not have the resources to warrant such measures. Health care dollars are currently wasted on PPD tests for inmates that are released before the test results are read (7.8% in 2006 and 6.7% in both years combined). Repeat offenders who are not kept for more than 48 hours at a time can also have PPD tests, which are not read because of prisoner release. This can potentially lead to multiple exposures of persons who are already may be at high risk because of their incarceration.

Early release presents the problem of continued care for inmates with LTBI and inmates released before reading of the TST. One previous study showed that only 43% of inmates with LTBI ever made a single visit to the health clinic after their release.[11] One theory is that inmates do not put a high priority on this aspect of health care, and the correctional institutions do not hold these prisoners responsible after release, towing to their own staffing and financial limitations. The compared sample population of the region was more likely to follow up, because their employment depends on the outcome of their TB test. Unlike patients with active TB, no such consequences befall released inmates with LTBI who do not necessarily need to follow up with the health department.

It is also important to note that not one case of LTBI in the rural regional jail data set has been treated for this condition. The short lengths of stay in jail mean inmates with TB or LTBI are often released before completing treatment.[8] Short-course treatment of LTBI, using 60 doses of daily rifampin and pyrazinamide, appear to be promising treatment options for populations such as jail inmates.[11] This two-month treatment regimen is comparable to the 6- to 9-month alternative of isonizid, although it does require much closer monitoring of liver function. This is an option for inmates; however, as mentioned before, the problem lies in continuation of treatment outside of the jail setting.

Finally, it is important to note that an inmate's positive TST could be a marker for HIV, another serious public health concern. Inmates with positive TST are 4.2 times more likely to be HIV-positive than inmates with a negative TST.[9] Adding further confusion, HIV-TB coinfections change the criteria for a positive TST reading, which is decorated to 5 mm. IF HIV is not identified, this may contribute to false-negative readings, thus changing the numbers reported. Although HIV is a significant disease in the jail population, it was not evaluated in this study.

Conclusion

The period prevalence of LTBI in a rural Ohio regional jail (0.8%) is lower than the comparative sample of hospital staff population (4.9%) of equally high-risk individuals in the same geographic region. The release of inmates (6.7%) indicates that this data is incomplete and that potential cases of LTBI could have been missed. If the rates of LTBI are accurate, it begs the question of cost-effectiveness of the screening program. In addition, interventions to improve adherence for the TST readings and treatment regimens are recommended. Also, the use of incentives may improve completion rates of skin tests and treatment.[11]

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