

# Assessment of Tuberculosis Screening and Management Practices of Large Jail Systems

---

AUDREY A. REICHARD, MPH<sup>a</sup>  
MARK N. LOBATO, MD<sup>a</sup>  
CHERYL A. ROBERTS, MPA<sup>b</sup>  
LAURI B. BAZERMAN, MS<sup>a</sup>  
THEODORE M. HAMMETT, PHD<sup>b</sup>

## SYNOPSIS

**Objective.** This descriptive study sought to explore the use and timeliness of tuberculosis (TB) screening and management activities in jail facilities.

**Methods.** Study personnel visited 20 large U.S. jail systems and reviewed the medical records of 56 inmates who had recently been evaluated for TB disease and 376 inmates who were diagnosed with or confirmed to have latent TB infection (LTBI). Data from these records were analyzed to determine completion and timeliness of screening, diagnostic, and treatment activities.

**Results.** In 14% of 56 inmates evaluated for TB disease and 24% of 376 inmates with LTBI, chest radiographs were either not performed or not documented. Of 48 inmates evaluated for TB disease who were not receiving treatment when admitted to jail, 10 had no record of sputum collection being done. A mean delay of 3.1 days occurred from symptom report to respiratory isolation. Time from tuberculin skin test reading to chest radiograph reading was a mean of 5.3 days in inmates evaluated for TB disease and a mean of 7.0 days in inmates with LTBI. Follow-up was arranged for 91% of released inmates who were on treatment for TB disease and only 17% of released inmates who were on treatment for LTBI.

**Conclusions.** Jail health information systems should be augmented to better document and monitor inmate health care related to TB. Completion rates and timeliness of TB screening, diagnostic, and treatment measures should be evaluated to identify areas needing improvement. Finally, mechanisms for continuity of care upon inmate release should be enhanced to promote therapy completion and prevent TB transmission in the community.

---

<sup>a</sup>Field Services and Evaluation Branch, Division of Tuberculosis Elimination, National Center for HIV, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, GA

<sup>b</sup>Abt Associates Inc., Cambridge, MA

Address correspondence to: Mark Lobato, National Center for HIV, STD, and TB Prevention, CDC, 1600 Clifton Rd., MS E-07, Atlanta, GA 30333; tel. 404-639-8125; fax 404-639-8958; e-mail <mlobato@cdc.gov>.

Tuberculosis (TB) case rates are much higher in correctional populations than in the general population.<sup>1,2</sup> Given the annual increases in the correctional population<sup>3</sup> and the continuous release of inmates back into the community, the need for public health department collaboration with correctional facilities is paramount.<sup>4</sup>

Higher rates of TB infection and disease among inmates have been related to several risk factors. HIV infection rates are higher among inmates than among the population at large,<sup>2,5</sup> and these HIV infections predispose infected inmates to develop active TB and possibly transmit TB to other inmates and jail staff.<sup>6,7</sup> In 43 of the 50 largest jails reporting data in 1999, an average of 2.3% of all inmates had known HIV infection, with the highest proportion of HIV-infected inmates in jails serving the largest populations.<sup>8</sup> Prior to incarceration, inmates may also face barriers to accessing the community health care services that are necessary for detection and treatment of TB.<sup>9,10</sup> Additionally, jail overcrowding leading to a large number of inmates sharing common air space,<sup>11</sup> recidivism,<sup>12,13</sup> multiple jail admissions, and longer jail stays<sup>13</sup> are contributing factors to TB transmission among this population.

Given the risk factors common to inmates and jail facilities, TB detection and prevention activities conducted by jails are essential to reducing the incidence of TB within this high-risk population. The Centers for Disease Control and Prevention (CDC) have established national TB prevention and control guidelines, including specific recommendations for correctional facilities.<sup>4</sup> These guidelines recommend screening all inmates for symptoms of TB. Any inmate with symptoms suggestive of TB should promptly have a tuberculin skin test (TST), a chest radiograph, and, if indicated, sputum examinations. Results of the chest radiograph and sputum-smear should be available within 24 hours. Inmates with no TB symptoms and positive TST results should receive a chest radiograph within 72 hours to detect any chest abnormalities. Subsequently, any individuals with chest radiograph results suggesting active TB disease should have sputum-smear and culture examinations. Any person with suspected or confirmed pulmonary or laryngeal TB disease should be placed in a respiratory isolation room immediately to help prevent transmission to others. Additionally, the guidelines recommend that correctional facilities have information systems in place to monitor the current TB status of inmates and assess the effectiveness of TB control activities.

Although TB prevention and control recommendations have been published,<sup>4,14</sup> there are no recent studies evaluating the use of these recommended practices

within correctional facilities. This study assessed the performance and timeliness of TB screening and control measures and examined the completeness of medical record keeping in 20 large jail systems.

## METHODS

This analysis was a component of a larger study evaluating TB control and prevention efforts in 20 city and county jail systems. Unlike prisons, where inmates are confined for longer terms, jails usually confine individuals before trial or after trial if the resultant sentence is two years or less. The average daily population of each of these jails was  $\geq 1,500$  inmates, and TB case rates in the jurisdictions served were greater than or equal to the national figure of 6.8 cases per 100,000 in 1998.<sup>15</sup> Participating jail systems were randomly selected by region (Northeast, Midwest, West, and South) to ensure that the total number selected from each region was proportional to the distribution across regions of same-size jail systems. Of the 20 jail systems selected, 18 had a chest radiograph available on-site; however, a radiologist was not on-site in most instances. Fifteen of the jail systems had either a negative pressure room on-site or used the local hospital for respiratory isolation.

Study personnel visited each of the 20 jail systems during 2000–2001. At the time of the visit, jail staff were asked to provide the records of the five most recently admitted inmates with TB disease; if the jail system did not have five cases since 1997, the staff were asked to include records of inmates suspected of and evaluated for TB disease. Jails were also asked to provide records for a sample of 25 inmates who were confirmed or diagnosed with latent TB infection (LTBI) in the 12 months prior to the site visit. Not every jail system was able to provide the requested number of TB or LTBI records. One jail system purposefully selected only TB disease charts of inmates on treatment; consequently, these were excluded from analyses examining the number of inmates started on treatment. The records were abstracted to obtain information on TB history and risk factors, screening and diagnostic measures, dates of starting and completing treatment, and follow-up after release or transfer. If a screening or diagnostic event occurred prior to the jail admission, the event time was excluded from the analyses, as it did not represent TB control measures taken by the jail system. Three jails were excluded from analyses of time to TST because they did not have policies to universally screen incoming inmates with TSTs.

Data were analyzed using SAS software, Version 8.02.<sup>16</sup> Frequencies, cross-tabulations, and measures of central tendency were calculated.

## RESULTS

### TB screening

At the time of admission to jail, eight of 56 inmates (14%) evaluated for TB were on treatment for known TB disease and 40 (71%) were diagnosed with TB disease before or during incarceration but were not on treatment at the time of admission to jail. Another five inmates (9%) were classified with suspected TB disease, but had no final diagnosis prior to release or death. Three others (5%) were initially classified with suspected TB disease, but TB was eventually ruled out. Among the 376 inmates with LTBI, 12 (3%) were on treatment for LTBI at admission; the remaining 364 (97%) were diagnosed with LTBI before or during incarceration but were not on treatment at the time of admission to jail.

More than half of the inmates evaluated for TB disease and a third of those with LTBI indicated having positive TST results prior to incarceration; however, only 16% of those evaluated for TB disease and 13% of those with LTBI had documentation of completed treatment for LTBI prior to incarceration (Table 1). A quarter or more of the inmates in each group had missing or unknown prior TST results.

Nearly 20% of the 56 inmates evaluated for TB disease were documented to be HIV-seropositive, and

3% of the 376 inmates with LTBI had a known seropositive HIV status (Table 2). Documentation of HIV status was limited; HIV status was unknown or missing for 29% of inmates evaluated for TB disease and 52% of inmates with LTBI.

Among the inmates evaluated for TB, 38% had a documented report of symptoms and 71% had documented chest radiograph readings with abnormal results (Table 2). Eight of the inmates evaluated for TB disease had normal chest radiograph results; four of the eight were known to be HIV-infected. Of the inmates with LTBI, 3% were documented as presenting with symptoms, and 73% had documented chest radiograph readings with normal results. Chest radiographs were either not performed or not documented for 14% of inmates evaluated for TB disease and 24% of those with LTBI.

### Isolation and evaluation of TB suspects

Among the 56 inmates evaluated for TB disease, 39 (70%) were placed in respiratory isolation at the jail or hospitalized some time during their incarceration. Information about isolation of the inmate was missing or unknown in eight (14%) inmate medical records. Another eight inmates (14%) had probable or definite cause for respiratory isolation but documentation indicated they had not been isolated.

Sputum collection was documented for 38 (79%) of the 48 inmates evaluated for TB disease who were not on treatment at admission; 28 (74%) had three or more sputum samples collected. Of the 38 inmates

**Table 1. Tuberculosis (TB) history of inmates evaluated for TB disease or diagnosed with latent TB infection (LTBI)**

Study sample	TB status prior to incarceration											
	TB diagnosis		TB treatment <sup>a</sup> started		TB treatment completed <sup>b</sup>		Positive TST		LTBI treatment <sup>c</sup> started		LTBI treatment completed <sup>b</sup>	
	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent
Evaluated for TB disease (n=56)												
Yes	16	28.6	13	81.3	1	7.7	30	53.6	21	70.0	9	42.9
No	30	53.6	1	6.3	9	69.2	12	21.4	5	16.7	5	23.8
Missing/unknown	10	17.9	2	12.5	3	23.1	14	25.0	4	13.3	7	33.3
Diagnosed with LTBI (n=376)												
Yes	3	0.8	1	33.3	—	—	131	34.8	88	67.2	47	53.4
No	296	78.7	2	66.7	—	—	146	38.8	22	16.8	37	42.1
Missing/unknown	77	20.5	—	—	1	100.0	99	26.3	21	16.0	4	4.6

<sup>a</sup>Among inmates with documented TB disease diagnosed prior to incarceration

<sup>b</sup>Among inmates who were documented to have begun treatment prior to incarceration

<sup>c</sup>Among inmates with positive TSTs prior to incarceration

**Table 2. Risk factors, screening, and treatment of inmates evaluated for tuberculosis (TB) disease or diagnosed with latent TB infection (LTBI)**

Variable	Evaluated for TB disease (n=56)		Diagnosed with LTBI (n=376)	
	n	Percent	n	Percent
HIV diagnosis				
Yes	11	19.6	10	2.7
No	29	51.8	169	45.0
Missing data	16	28.6	197	52.4
HIV risk factors				
Yes	17	30.4	36	9.6
No	11	19.6	72	19.1
Missing data	28	50.0	268	71.3
Symptoms reported				
Yes	21	37.5	12	3.2
No	32	57.1	265	70.5
Missing data	3	5.4	99	26.3
Chest x-ray result				
Normal	8	14.3	274	72.9
Abnormal	40	71.4	12	3.2
Not done	5	8.9	56	14.9
Missing data	3	5.4	34	9.0
Treatment started	(n=43) <sup>a</sup>		(n=313) <sup>b</sup>	
Yes	33	76.7	143	45.7
No	9	20.9	157	50.2
Missing data	1	2.3	13	4.2
Treatment completed in jail	(n=40) <sup>c</sup>		(n=150) <sup>c</sup>	
Yes	6	15.0	31	20.7
No	25	62.5	39	26.0
On treatment	5	12.5	70	46.7
Missing data	4	10.0	10	6.7

<sup>a</sup>Excluding 13 inmates who entered jail on treatment and inmates from the jail system that did not provide data on untreated inmates

<sup>b</sup>Excluding 63 inmates who were documented as having previously completed LTBI treatment, who entered the jail on treatment, or came from jail systems that did not provide data on untreated inmates

<sup>c</sup>Excluding five inmates evaluated for TB and eight inmates with LTBI from jail systems that did not provide data on untreated inmates

with documented sputum collection, smear results were missing for five (13%) inmates and culture results were missing for 11 (29%).

### Treatment

Treatment was started for 77% of 43 eligible inmates evaluated for TB disease but not on treatment at admission, but for only 46% of those with LTBI who were not already on treatment or had not previously completed LTBI treatment (Table 2). Treatment completion rates in jail were low. Excluding inmates in jail and on treatment at the time of data collection, six (17%) inmates on treatment for TB disease completed treatment and 31 (39%) inmates on treatment for LTBI completed treatment. Of the 31 inmates who did complete treatment for LTBI, nine completed a prescribed two-month regimen of rifampin and pyrazinamide. For a third (33%) of inmates who began LTBI treatment but did not complete it while in jail, more than 60 days elapsed from their treatment start date to jail release date (Table 3).

Of inmates who were released from jail while on treatment, 20 (91%) evaluated for TB disease and only five (17%) with LTBI had follow-up arrangements documented. Information on treatment continuation was unknown or missing for one inmate with TB and 11 inmates (37%) with LTBI.

### Timeliness of TB evaluations

The median length of stay (i.e., length of time available for TB screening and interventions prior to release) was 45 days (mean 68 days) for inmates evaluated for TB disease and 31 days (mean 52 days) for inmates with LTBI. The median time for TST placement was less than a day from admission (Table 3). Two inmates evaluated for TB disease and 25 inmates with LTBI (12%) had TSTs placed more than 14 days after admission. The time elapsed from TST reading to chest radiograph reading was a median of two days (mean 5.3 days) for inmates evaluated for TB disease and three days (mean 7.0 days) for inmates with LTBI. The time elapsed was more than three days for four inmates (33%) evaluated for TB disease and 80 inmates (44%) with LTBI.

The median elapsed time from jail admission to the reporting of TB symptoms in inmates evaluated for TB disease was less than one day (Table 4). The median time from the report of symptoms to the respiratory isolation of the inmate was less than one day. However, of the 12 inmates with dates documented for symptom report and respiratory isolation, four inmates (33%) reported symptoms 3 to 21 days prior to isolation.

**Table 3. Days between diagnostic and treatment events for inmates evaluated for tuberculosis (TB) or diagnosed with latent TB infection (LTBI)**

Events	Evaluated for TB disease	Diagnosed with LTBI
Date of admission to date TST placed <sup>a</sup>	(n=17)	(n=241)
Mean (days)	3.3	4.6
Median (days)	<1	<1
Missing data (number of inmates missing event dates)	2	37
Date of TST reading to date of chest x-ray reading <sup>a</sup>	(n=16)	(n=203)
Mean (days)	5.3	7.0
Median (days)	2.0	3.0
Chest x-ray before TST (number of inmates)	—	3
Missing data (number of inmates missing event dates)	4	20
Date treatment started to date treatment completed <sup>b</sup>	(n=5)	(n=21)
Mean (days)	199	192
Median (days)	188	184
Missing data (number of inmates missing event dates)	2	5
Date treatment started to date of release <sup>c</sup>	(n=19)	(n=23)
Mean (days)	43	60
Median (days)	37	38
Missing data (number of inmates missing event dates)	3	8

<sup>a</sup>Excluding 10 inmates evaluated for TB and 44 inmates with LTBI from three jail systems that screened with chest radiograph or other criterion

<sup>b</sup>Excluding eight inmates evaluated for TB and 12 inmates with LTBI who entered jail on treatment, and nine inmates given two-month rifampin and pyrazinamide treatment for LTBI

<sup>c</sup>Among inmates who did not complete treatment and who did not enter the jail on treatment

TST = tuberculin skin test

Three inmates with TB disease had crucial delays in the diagnosis of their TB. Two inmates were initially diagnosed with a respiratory illness unrelated to TB, despite documentation of known exposure to TB in one of these inmates. This resulted in failure to isolate the inmates and a delay of up to 10 months in reaching a TB diagnosis. Another inmate presenting with TB-related symptoms and a previously positive TST was diagnosed with TB meningitis one day postmortem, nearly five months after admission to jail.

The median time from chest radiograph to respiratory isolation for inmates with abnormal radiograph findings was 0.5 days (mean 3.4 days) (Table 4). Eight (27%) inmates were not isolated until two or more days following an abnormal chest radiograph report. Among all inmates placed in respiratory isolation, acid-fast bacilli (AFB) sputum smears were ordered in median and mean times of one day.

Analyses of time elapsed to the start of treatment excluded inmates who entered jail on treatment. For inmates with LTBI who started treatment while in jail,

a median time of 18 days (mean 33.8 days) elapsed between the chest radiograph reading and the start of treatment. Of 10 inmates with TB disease for whom documentation was available, only six started treatment for TB disease within seven days of symptom report.

## DISCUSSION

This study examined current TB screening, respiratory isolation, and treatment practices of 20 large city and county jail systems. We found that critical TB control guidelines were not being uniformly implemented in the jails studied. In addition, the amount of information that was missing or unknown in the medical records was significant, hindering the medical management of patients and precluding evaluation of TB prevention and control practices.

A notable example of the failure to fully implement CDC guidelines<sup>4</sup> was the fact that eight inmates were evaluated for TB disease but not isolated, despite being appropriate candidates for isolation to prevent

**Table 4. Days between diagnostic and treatment events for inmates evaluated for TB disease**

Events	
Date of admission to date of symptom report (n=21)	
Mean (days)	4.7
Median (days)	<1
Missing data (number of inmates missing event dates)	6
Date of symptom report to date of chest x-ray reading (n=19)	
Mean (days)	4.9
Median (days)	6.0
Chest x-ray before symptom report (number of inmates)	2
Missing data (number of inmates missing event dates)	7
Date of symptom report to date of isolation (n=15)	
Mean (days)	3.1
Median (days)	<1
Missing data (number of inmates missing event dates)	3
Date of chest x-ray reading to date of isolation <sup>a</sup> (n=31)	
Mean (days)	3.4
Median (days)	0.5
Isolated before chest x-ray (number of inmates)	6
Missing data (number of inmates missing event dates)	1
Date of chest x-ray reading to date of AFB order <sup>a</sup> (n=35)	
Mean (days)	3.1
Median (days)	1.0
AFB ordered before chest x-ray (number of inmates)	5
Missing data (number of inmates missing event dates)	4
Date of isolation to date treatment started (n=34)	
Mean (days)	3.9
Median (days)	1.0
Treatment began before isolation (number of inmates)	2
Missing data (number of inmates missing event dates)	3

<sup>a</sup>Among inmates with abnormal chest x-ray results

AFB = acid-fast bacilli sputum smear

possible transmission within facilities. Also, more than 40% of the inmates evaluated for TB disease did not have documentation of three or more initial sputum samples collected, as recommended for the diagnosis of TB and monitoring of treatment.

Included among the notable findings for inmates with LTBI were poor rates of treatment initiation and completion and limited arrangements for continuity of care following release. Almost half of inmates eligible for LTBI treatment were not started on treatment that can prevent the development of TB disease and subsequently halt further transmission among this high-risk population. CDC recommends evaluating all high-risk individuals for preventive treatment and be-

ginning treatment unless there are medical contraindications. Those who are not considered at high risk should begin treatment only if they are likely to complete at least six months of the nine-month treatment course.<sup>4</sup> A 60-dose treatment of rifampin and pyrazinamide had been used by some jails prior to reports of severe hepatitis and death.<sup>17-19</sup> Data suggest that approximately a third of inmates would have had the opportunity to complete a 60-day regimen during incarceration. Fewer than 20% of inmates released before completing treatment for LTBI were documented as having been referred to follow-up services. Moreover, even with referrals, follow-up is difficult to ensure. Tulsky and colleagues documented that of 93 jail

inmates on treatment for LTBI, only three reported to the clinic they were referred to within one month of their release from jail.<sup>20</sup> In a study of inmates enrolled in an outreach program during incarceration and referred for directly observed LTBI treatment upon release from jail, 40% were never located following release.<sup>21</sup> Without coordination between jails and health departments, health care is potentially compromised.<sup>4,10</sup>

Despite recommendations to immediately isolate any inmate presenting with symptoms of TB or suspected of having TB disease, delays in isolation existed for one-third of inmates evaluated for TB disease who reported the presence of symptoms. Isolation was delayed for more than a quarter of those with abnormal chest radiograph results who were isolated. Diagnostic delays were also identified. Two inmates evaluated for TB and 25 with LTBI had a delay of more than 14 days to TST placement, beyond the limit for testing recommended by CDC.<sup>4</sup> More than 40% of inmates with LTBI had post-TST chest radiograph interpretations later than the recommended three-day time for screening. Delays in timely TB screening and isolation of TB suspects may place inmates and jail staff at risk for exposure and transmission of TB.<sup>4</sup>

The evaluation of TB control practices was hampered by the lack of efficient and easily accessible information systems. Despite recommendations for the development of medical records systems that would allow for assessment and continuity of care for inmates as they are moved between facilities or discharged,<sup>4</sup> the medical records of inmates in this study were frequently incomplete. We were unable to determine whether missing information was more likely to reflect a failure to complete TB diagnostic and management activities or a failure to document activities that did occur. These two possibilities have different implications for improving current jail TB prevention and control programs.

Documentation of TB history and risk factors was frequently based on inmate self-report, and dated events were not consistently well-defined (e.g., date of TST placement vs. date of reading), limiting the reliability of these data. Additionally, a potential bias in the selection of records was posed by the inability of several jails to use their information systems to provide random samples of LTBI records.

## CONCLUSIONS

Several important areas of TB prevention and control need improvement within the jail systems studied. First, jails need up-to-date electronic information systems that can be used to monitor inmate health care re-

lated to TB. Periodic review of TB data is important to assess the effectiveness of TB control efforts. Until adequate information systems are in place, it will not be possible to evaluate TB control efforts in jail systems. In addition, once electronic systems are developed and refined, they could facilitate the sharing of information with local TB control programs responsible for the care of inmates upon release. Second, the completion and timeliness of screening, diagnostic, and treatment measures need improvement as core activities of TB prevention and control in jail facilities. Third, given the short stays of many inmates, discharge planning and mechanisms for continuity of care need to be in place for those released from jail. Continuity of treatment would facilitate completion of therapy and help decrease the transmission of TB in the community.

The authors thank the staff and administration of the participating institutions for their cooperation and assistance in gathering data for this report.

## REFERENCES

1. Hutton MD, Cauthen GM, Bloch AB. Results of a 29-state survey of tuberculosis in nursing homes and correctional facilities. *Public Health Rep* 1993;108:305-14.
2. Hammett TM, Harmon MP, Rhodes W. The burden of infectious diseases among inmates of and releasees from US correctional facilities, 1997. *Am J Public Health* 2002; 92:1789-94.
3. Beck AJ, Karberg JC, Harrison PM. Prison and jail inmates at midyear 2001. Pub. No. NCJ-191702. Bureau of Justice Statistics Bulletin 2002 Apr:1-16 [cited 2003 May 15]. Available from: URL: <http://www.ojp.usdoj.gov/bjs/pub/pdf/pjim01.pdf>
4. Prevention and control of tuberculosis in correctional facilities: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR Recomm Rep* 1996;45(RR-8).
5. Dean-Gaitor HD, Fleming PL. Epidemiology of AIDS in incarcerated persons in the United States, 1994-1996. *AIDS* 1999;13:2429-35.
6. Drug-susceptible tuberculosis outbreak in a state correctional facility housing HIV-infected inmates—South Carolina, 1999-2000. *MMWR Morb Mortal Wkly Rep* 2000;49:1041-4.
7. Tuberculosis outbreaks in prison housing units for HIV-infected inmates—California, 1995-1996. *MMWR Morb Mortal Wkly Rep* 1999;48:79-82.
8. Maruschak LM. HIV in prisons and jails, 1999. Pub. No. NCJ-187456. Bureau of Justice Statistics Bulletin 2001 Jul:1-12 [cited 2003 May 15]. Available from: URL: <http://www.ojp.usdoj.gov/bjs/pub/pdf/hivpj99.pdf>
9. Conklin T, Lincoln T, Flanigan T. A public health model to connect correctional health care with communities. *Am J Public Health* 1998;88:1249-50.

10. Hammett TM, Gaiter JL, Crawford C. Reaching seriously at-risk populations: health intervention in criminal justice settings. *Health Educ Behav* 1998;25:99-120.
11. MacIntyre CR. Impact of TB control measures and crowding. *Clin Infect Dis* 1997;24:1060-7.
12. Stead W. Undetected tuberculosis in prison: source of infection for community at large. *JAMA* 1978;240:2544-7.
13. Bellin EY, Fletcher DD, Safyer SM. Association of tuberculosis infection with increased time in or admission to the New York city jail system. *JAMA* 1993;269:2228-31.
14. Essential components of a tuberculosis prevention and control program: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR Recomm Rep* 1995;44(RR-11):1-16.
15. Centers for Disease Control and Prevention (US). Reported tuberculosis in the United States, 1998. Atlanta: CDC; 1999 Aug. p. 2-15.
16. SAS Institute Inc. SAS, Version 8.02. Cary (NC): SAS Institute; 1999.
17. Fatal and severe hepatitis associated with rifampin and pyrazinamide for the treatment of latent tuberculosis infection—New York and Georgia, 2000. *MMWR Morb Mortal Wkly Rep* 2001;50:289-91.
18. Update: fatal and severe liver injuries associated with rifampin and pyrazinamide for latent tuberculosis infection, and revisions in American Thoracic Society/CDC recommendations, United States, 2001. *MMWR Morb Mortal Wkly Rep* 2001;50:733-5.
19. Update: fatal and severe liver injuries associated with rifampin and pyrazinamide treatment for latent tuberculosis infection. *MMWR Morb Mortal Wkly Rep* 2002; 51:998-9.
20. Tulskey JP, White MC, Dawson C, Hoynes TM, Golden-son J, Schecter G. Screening for tuberculosis in jail and clinic follow-up after release. *Am J Public Health* 1998; 88:223-6.
21. Nolan CM, Roll L, Goldberg SV, Elarth AM. Directly observed isoniazid preventive therapy for released jail inmates. *Am J Respir Crit Care Med* 1997;155:583-6.