

# The Correctional Facility Challenge to Public Health Efforts to Control Tuberculosis in the United States

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## Synopsis

In recent years, as the incidence of tuberculosis (TB) has declined in the overall U.S. population, it has also decreased among correctional inmates. However, TB incidence still remains much higher among inmates than among other segments of the population: in 1998, 3.6% of all cases of TB reported in the United States occurred among residents of correctional facilities, and reports of TB outbreaks in these settings remain frequent. This high proportion of cases reported from correctional facilities is due to a combination of factors, including a high number of incident cases in the incarcerated population and active case finding among a high-risk group that often has limited access to other health care services. For many geographic areas, correctional facility inmates significantly contribute to TB morbidity. In the United States more than a half million inmates are discharged each year from federal and state correctional institutions and almost 10 million from jails. Concentrating TB control strategies on the incarcerated populations will significantly decrease morbidity in these settings and in the communities from which the inmates come or to which they return. One such strategy is the complete implementation of TB control guidelines for correctional facilities. These guidelines advocate maintaining aggressive policies for screening inmates and staff for TB infection and TB disease, initiating and completing directly observed therapy regimens, and using infection control measures to minimize transmission of *M. tuberculosis*. Upon incarceration, a prisoner's health care becomes the legal responsibility of the correctional system. However, the impact of TB within jails and prisons on the general community and viceversa makes collaboration essential. TB control programs at the local and national level should develop well-defined procedures for interagency collaboration on TB treatment and control with correctional institutions. This collaboration is one of the most important steps for successful control of correctional facility-related TB.

## Resumen

Recientemente, a la vez que la incidencia de la tuberculosis (TBC) ha decrecido en la población general de EEUU, también ha disminuido entre los presos. Sin embargo su incidencia aún permanece mucho más alta entre los presos que entre otros segmentos de la población: en 1998, el 3,6% de los casos notificados en EEUU ocurrieron en presos, y los brotes de TBC en instituciones penitenciarias siguen siendo frecuentes. Esta alta proporción de casos reportados desde estas instituciones se debe a una combinación de factores, incluyendo un alto número de casos incidentes en presos y la búsqueda activa de casos en un grupo de alto riesgo que con frecuencia tiene limitado acceso a los servicios de salud. En muchas áreas geográficas, los presos contribuyen significativamente a la morbilidad tuberculosa. En EEUU, más de medio millón de presos salen en libertad de las instituciones penitenciarias estatales y federales y casi 10 millones desde centros preventivos. La priorización de las estrategias de control de la TBC en los presos disminuirá significativamente la morbilidad en estos lugares y en las comunidades de procedencia o a las que irán cuando obtengan la libertad. La estrategia se basa en la implementación completa de las guías de control de la TBC en las instituciones penitenciarias. Estas guías abogan por el mantenimiento agresivo de las políticas de cribaje de presos y del personal en relación a la infección y enfermedad tuberculosa, iniciando y completando los regímenes de tratamiento directamente observado, y usando las medidas de prevención de la infección a fin de evitar la transmisión de *M. tuberculosis*. Durante el encarcelamiento, el cuidado de la salud del preso es responsabilidad legal del sistema penitenciario. Sin embargo, el impacto de la TBC entre instituciones penitenciarias y la comunidad hace que la colaboración sea esencial. Los programas de control de la TBC a escala nacional y local deben desarrollar procedimientos bien definidos con buena colaboración entre los programas intra y extrapenitenciarios. En relación al tratamiento y control de la TBC. Esta colaboración es uno de los más importantes pasos en el control exitoso de la TBC relacionada con las instituciones penitenciarias.

From 1953, when national surveillance for tuberculosis (TB) began in the United States, through 1984, TB incidence rates declined approximately 6% per year<sup>(1)</sup>. From 1985 through 1992, the national case rate showed an upward trend that at its highest (1992) represented a TB incidence rate of 10.5 per 100,000 population. During 1998 (latest complete reporting year), a total of 18,361 TB cases (6.8 per 100,000 population) were reported to the Centers for Disease Control and Prevention (CDC), representing a 7.5% decrease from 1997, a 31% decrease from 1992, and the lowest reported case rate since the start of surveillance for TB<sup>(1)</sup>.

A closer look at these favorable nationwide statistics, however, reveals that not all Americans are affected equally by TB: there are significant differences in the prevalence of *M. tuberculosis* infection and active TB disease among different segments of the U.S. population. For example, during 1998, 60% of the total number of TB cases were reported by only seven states (California, Florida, Georgia, Illinois, New Jersey, New York, and Texas). Thus, geographic location has a recognized influence on the risk for TB. An increased risk for TB has also been recognized for persons who reside or work in certain settings, for example, correctional facilities. In 1998, 3.6% (661) of all cases of TB reported in the United States occurred among residents of correctional facilities<sup>(1)</sup>, and the transmission of TB to employees of such facilities has been frequently observed during investigations of TB outbreaks<sup>(2,3)</sup>. In this article, we review the epidemiology of TB in correctional facilities, the transmission of *M. tuberculosis* in these settings, and the consequences of

correctional-facility TB for the surrounding community. We also discuss current strategies for managing, preventing, and controlling TB in correctional institutions.

### Epidemiology and Risk Factors for TB in Correctional Facilities

In many geographic areas of the United States, the TB case rates for prison populations are markedly higher than the rates for the general population in that area. Table 1 shows the areas that report the highest numbers of TB cases to the CDC, and the percentage of those cases that were reported in residents of a correctional facility at the time of diagnosis in 1998<sup>(1)</sup>. This high proportion of cases reported from correctional facilities is due to a combination of factors, including a high number of incident cases in the incarcerated population and active case finding among a high-risk group that often has limited access to other health-care services. In the United States, correctional facility–related TB case rates vary among states and among institutions within states. In the New York State correctional system in 1990 and 1991 there were 156 cases per 100,000 inmate years, compared with 24 per 100,000 for the general population of New York State<sup>(2)</sup>. In one California state prison, the annual incidence rate of TB disease in 1991 was 184 cases per 100,000—more than 10 times the statewide annual incidence rate<sup>(4)</sup>. In Georgia, however, the case incident rate in the prison system from 1991 to 1995 was only 2.6 times greater than the average annual general population rate of 12 per 100,000 population<sup>(5)</sup>.

Reporting Area	Total Cases	Cases with Information on Resident of Correctional Facility		Percent of Cases in Residents of Correctional Facilities(a)
		No.	%	
United States	18,361	18,260	99.4	3.6(b)
California	3,852	3,840	99.7	3.6
Florida	1,302	1,301	99.9	4.5
Georgia	631	631	100.0	4.9
Illinois	850	845	99.4	2.8
New Jersey	640	640	100.0	0.9
New York State (c)	442	442	100.0	5.7
New York City	1,558	1,558	100.0	2.8
Texas	1,820	1,805	99.2	8.3

(a)Resident of correctional facility at time of diagnosis. Percentages shown only for reporting areas with information reported for ≥75% cases.  
 (b)Percentage based on data from 52 areas reporting information on resident of correctional facility for ≥75% of cases.  
 (c)Excludes New York City.

Table 1. Tuberculosis Cases in Residents of Correctional Facilities: Top Reporting Areas, 1998

In recent years, as the incidence of TB has declined in the overall U.S. population, it has also decreased among correctional inmates. However, TB incidence remains much higher among inmates than among other segments of the population. This in part reflects changes in the makeup of the TB patient population in the United States: the overall decrease in TB morbidity has made evident an increased concentration of TB among the poor and nonwhites, the populations from which the majority of correctional inmates are drawn<sup>(6)</sup>. In 1998, the Nation's TB case rates per 100,000 population for males between 25 and 44 years by race/ethnicity was 2.4 for non-Hispanic whites, compared to 29.4 for non-Hispanic blacks and 21.6 for Hispanics of any race<sup>(1)</sup>. The demographic characteristics and prevalence of latent TB infection among residents of correctional facilities have been estimated through a collaborative project established between state departments of health, departments of correctional services, and CDC, that ran from 1991 to 1995<sup>(7)</sup>. The project, conducted among 47 participating correctional facilities, consisted of screening all incoming inmates with a tuberculin skin test (TST), evaluating all those who had TST results of  $\geq 5$  mm to rule out active TB disease and offer HIV testing, and administering isoniazid (900 mg) twice weekly for 6 or 12 months based on the HIV test results. Over the 5 years of the project 199,379 persons were screened; their median age was 30, 93% of them were males, 45% non-Hispanic blacks, and 24% Hispanics; the prevalence of a positive TST was 11% (range 3.9% to 27.6%). In addition to this large project, several studies conducted among correctional facilities in the U.S. have also demonstrated a high prevalence of TB infection among inmates, ranging from 14% to 25%<sup>(8-11)</sup>.

Infection with the human immunodeficiency virus (HIV) is the strongest known risk factor for the development of TB disease among adults who have latent TB infection<sup>(12-14)</sup>. At year-end 1996, 2.3% of all state and federal prison inmates were known to be infected with HIV<sup>(6)</sup>. The overall rate of confirmed cases of acquired immunodeficiency syndrome (AIDS) among the Nation's prison population (0.54%) was about six times the rate in the U.S. population (0.09%). Braun and coworkers reported a 7-fold increase in the incidence of TB among inmates in the New York State prison system between 1976 and 1986<sup>(15)</sup>. During that period the proportion of TB cases in inmates with HIV infection increased from 0% to 56%. HIV infection among correctional facility inmates is primarily associated with a history of drug injection.

Following widespread implementation of mandatory sentencing for drug users beginning in the early 1990s, an increased proportion of inmates are drug offenders<sup>(16)</sup>. In a 1991 survey of more than 20,000 state and federal prisoners in 45 states, 25% of the inmates reported a recent history of drug injection and 44% reported ever having injected drugs<sup>(17)</sup>. Thus, residents of correctional facilities have a high risk for TB because a disproportionately high number of them are infected with *M. tuberculosis* and also have risk factors for the development of TB disease, such as HIV infection, a history of drug use, or both.

### Transmission of *M. tuberculosis* Within Correctional Facilities

If inmates develop TB, the physical structures and overcrowded environments of most correctional facilities promote the transmission of *M. tuberculosis*. Additionally, the rotation of prisoners from one facility to another, a common practice in some correctional systems, enables transmission from one physical setting to another. Since 1985, at least 17 TB outbreaks in U.S. prisons and jails have been reported in the literature<sup>(3)</sup>. A few selected outbreaks will be highlighted here.

In 1978 Stead and coworkers reported an outbreak in a prison in Arkansas in which, over a 12-month period, 10 cases of TB occurred among 1,500 prisoners who were not likely to be infected with HIV (incidence rate 670/100,000 for that year)<sup>(18)</sup>. During the course of the investigation the transmission of TB within the prison was documented by a cohort analysis that showed a 40% TST conversion rate among inmates who had a negative in 1973 (first year with available records) and remained confined until 1977 (last year of the investigation). Extramural transmission of *M. tuberculosis* was also shown as a consequence of this prison TB outbreak: a case of TB that occurred in an exposed inmate after his release from prison resulted in TB infection of others (his wife and 2 children) in his household.

In 1995-1996, two outbreaks of TB occurred in California in correctional facilities that had special units for HIV-positive inmates<sup>(19)</sup>. In the first situation, an inmate who had no apparent symptoms of TB upon admission to the correctional-facility HIV unit developed a new infiltrate on chest x-ray,

acid fast bacilli (AFB)–positive smears, and cultures positive for *M. tuberculosis* after a 3-month stay. Within 8 months of his diagnosis there were 14 other cases of TB among inmates exposed to the source case (three of these secondary cases were diagnosed after their release from prison), and one case of TB occurred in a family contact (spouse) who visited the source case in prison. All 15 secondary cases had a fingerprint pattern on restriction fragment length polymorphism (RFLP) analysis that was identical to the pattern from the *M. tuberculosis* isolate obtained from the source case. In the second outbreak situation, there was a delayed diagnosis of active TB in an inmate newly diagnosed with HIV infection and previously diagnosed and treated for latent TB infection. This delay resulted in 15 secondary TB cases diagnosed within the 8 months following the death due to TB of the source case. RFLP analysis in this outbreak also matched and confirmed the exposure history links investigated for these secondary cases of TB. The magnitude and rapidity of the *M. tuberculosis* transmission in these two outbreaks illustrate the difficulty of diagnosing TB in HIV-infected persons and the disastrous consequences of this, as well as the rapid progression from exposure to disease that can be seen in immunosuppressed HIV-infected persons newly infected with TB.

Health care and correctional workers have been affected by outbreaks of TB in correctional facilities. In 1990 and 1991 in the New York State correctional system there was an outbreak of multidrug-resistant TB (MDRTB) caused by a strain of *M. tuberculosis* that was resistant to seven drugs and that had a unique RFLP fingerprint pattern (Strain W)<sup>2, 20</sup>. As a result of delayed diagnosis and multiple opportunities for transmission of *M. tuberculosis* 9 cases of MDRTB occurred in inmates housed in different prisons within this correctional system. There were also three other MDRTB cases detected among noninmate patients after they were exposed to inmates hospitalized with infectious TB, and two occupational MDRTB cases, one in a prison worker assigned to guard an inmate hospitalized with infectious TB and one in a worker from an autopsy suite<sup>(21, 22)</sup>. Following exposures to cases of MDRTB, 30% of prison inmates and 20% of health care workers from the hospital where diseased inmates were admitted showed TST conversions<sup>(2, 20, 21)</sup>. New TB cases and incidence rates among inmates in the New York State correctional system have declined after the occurrence of this very serious outbreak, as shown in Figure 1. The institution

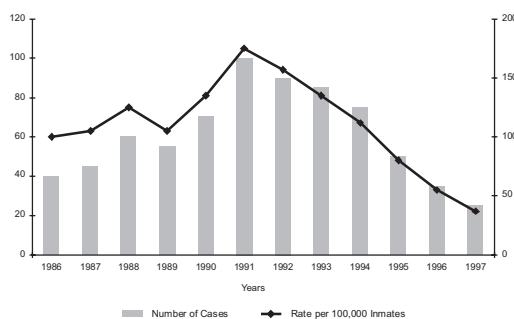


Figure 1. Tuberculosis Cases and Rates Among New York State Inmates (Exclusive of New York City), 1986-1997

Source: New York State Department of Tuberculosis Control: Tuberculosis in New York State, 1997 Annual Statistical Report

of mandatory intake and subsequent annual TST screening of inmates and staff, as well as universal directly observed therapy (DOT) for TB disease, complete treatment of TB infection, and strict isolation of persons known or suspected to have infectious TB were probably responsible in large measure for this decline. The New York State policy has been used as a model for the control and management of TB in the correctional setting<sup>(6)</sup>.

## Consequences of Correctional-Facility TB to the Surrounding Communities

The transmission of *M. tuberculosis* in correctional facilities affects not only the incarcerated inmates, but also the communities into which they are released. The consequences to these communities are several. **First**, because some correctional facilities are environments of transmission, inmates may become infected with *M. tuberculosis* while incarcerated. Once released back into the community they may develop and transmit TB. Two studies have shown a correlation between TST positivity rates and length of time in prison, suggesting that *M. tuberculosis* transmission occurs within correctional facilities<sup>(18, 23)</sup>. A 25-site national survey of TB infection and use of preventive therapy among inmates in correctional facilities found that approximately 25% of the inmates being discharged annually may be infected with TB<sup>(10)</sup>. In 1978 Dr. William Stead described a

TB outbreak in an Arkansas state prison and traced the transmission from there to 9% of all cases occurring in the state of Arkansas during a 5-year study period<sup>(18)</sup>. A population-based study in Nassau County, New York, between 1988 and 1990 found that 24% of 205 cases in this county occurred in jail inmates, former inmates, jail employees, or their community contacts<sup>(24)</sup>. Jones and colleagues more recently showed that 43% of persons in Memphis diagnosed with TB from January 1995 to July 1997 had been incarcerated in the city's jail sometime before the diagnosis<sup>(3)</sup>. **Second**, inmates receiving anti-TB treatment may be released before completing therapy, and many are then lost to follow-up. In the state of Georgia over the 5-year period 1991 through 1995, 38% of inmates under treatment for TB in the state prison were lost to follow-up after being released to the community<sup>(5)</sup>. In Seattle, Washington, 43% of inmates started on isoniazid preventive therapy were never located after release from jail, despite an aggressive outreach program<sup>(26)</sup>. **Third**, employees of prisons and jails can become infected in the workplace, then develop TB and transmit it to their families and contacts in the community. A New York State prison employee developed MDRTB and died after exposure during a TB outbreak in the prison system in 1990 and 1991<sup>(2)</sup>. Five guards of a large urban jail were diagnosed with active TB during a 3-year period (1995-1997) when a large outbreak of TB occurred at this facility<sup>(3)</sup>. Of the five guards, two had culture-positive disease and had *M. tuberculosis* isolates with an RFLP fingerprint pattern that was identical to the predominant strain isolated from inmates with TB. According to CDC surveillance data, 18 correctional staff were diagnosed with TB disease in 1997, although it is not known how many of these cases resulted from occupational exposure<sup>(6)</sup>. **Fourth**, as the result of the active case-finding among new admissions undertaken by some prison systems, the detected cases are managed by prison health services, which are usually separate from the local TB control program. Communication between the two programs is often poor, and cases detected at entry into the prison system often do not have contact investigations conducted in the communities or jails where they may have transmitted TB prior to admission to the prisons. In a study done over an 11-week period in a New York City jail, 25 (78%) of 32 TB cases found among 4,172 new jail admissions were detected by cross-checking these

admissions against the computerized New York City TB Registry<sup>(26)</sup>. Many of these matched cases were known to the health department program as defaulters from anti-TB treatment. Two thirds of the TB cases treated in the Georgia state prison system from 1991 to 1995 were detected during active case finding upon admission<sup>(5)</sup>. Even though most of these persons had been living in the community or in a county jail just prior to admission to the prison, the researchers conducting this evaluation did not find evidence of a contact investigation conducted for 75% of these cases. In the United States more than a half million inmates are discharged each year from federal and state correctional institutions<sup>(27)</sup> and almost 10 million from jails<sup>(28)</sup>. Upon incarceration, a prisoner's health care becomes the legal responsibility of the correctional system. However, the impact of TB within jails and prisons on the general community and vice versa makes collaboration essential. TB control programs at the local and national level should develop well-defined procedures for interagency collaboration on TB treatment and control with correctional institutions (Table 2).

## Management, Prevention, and Control of TB in Correctional Facilities

State or local health department personnel should assist correctional facility officials by reviewing and ensuring that the TB infection control plans developed for the facilities include the essential TB control activities<sup>(29, 30)</sup>. These essential activities can be divided into three categories (Table 3).

**Screening** refers to the measures used to identify persons who have TB disease or TB infection, and include promptly recognizing all persons in the system or facility who have suspected or confirmed TB disease, and diagnosing staff and long-term inmates who are latently infected with *M. tuberculosis* (i.e., those with a positive TST) and evaluating them for treatment.

**Containment** refers to the management of persons who have TB disease or infection to prevent further or future transmission of *M. tuberculosis* and includes

1. Placing persons suspected of having infectious TB disease in an appropriate TB isolation room

Role of Correctional Facility (CF)	Role of Health Department
Carry out TB control activities in facility according to current guidelines (Screening, Containment, Assessment, see Table 3)	Designate a specific person to work with CFs Assist Cfs in developing, implementing, and updating:
Develop formal agreements with health department for help with:	<ul style="list-style-type: none"> <li>· TB control policies and procedures</li> <li>· training and educational programs</li> <li>· tracking and patient record systems</li> <li>· HIV prevention programs</li> </ul>
<ul style="list-style-type: none"> <li>· contact investigations</li> <li>· follow-up of inmates released before completing</li> </ul>	Ensure that released inmates complete therapy
Collaborate and consult with health department for training and education	Assist with contact investigations in Cfs
	Analyze TB morbidity in Cfs
	Provide or refer to expert clinical consultation
	Ensure access to adequate laboratory services

Table 2.  
A Model for Correctional Facility – Health Department Collaboration for TB Control

- immediately, and promptly carrying out a thorough contact investigation if an exposure has occurred;
2. Promptly initiating an adequate anti-TB regimen for persons who have suspected or confirmed TB disease, using DOT for all patients; and
  3. Evaluating persons who have latent TB infection and offering treatment when appropriate. Treatment of latent TB infection given in correctional facilities should also be directly observed if feasible.

**Assessment** refers to the monitoring and evaluation of screening and containment activities. It includes the collection and analysis of

1. Screening data to ensure that transmission is not occurring;

2. Surveillance data to ensure that cases of TB disease are promptly reported, counted, and recorded; and
3. Case management data to assess the extent to which persons who have TB infection and disease begin and complete a recommended course of therapy in the facility, and to which referrals to health departments or other correctional facilities are made in a timely fashion and confirmed.

Control of TB is an essential element in correctional health care. All correctional facilities—even facilities in which few cases of TB are expected—should have a written TB infection control plan that includes these three essential activities and should designate a person or group of persons who will be responsible for the TB

Screening	Containment	Assessment
<ul style="list-style-type: none"> <li>· Promptly identify persons who have confirmed or suspected TB disease</li> </ul>	<ul style="list-style-type: none"> <li>· Promptly isolate persons suspected of having infectious TB</li> </ul>	<ul style="list-style-type: none"> <li>· Maintain up-to-date, organized records for risk assessment and program review</li> </ul>
<ul style="list-style-type: none"> <li>· Report confirmed or suspected TB cases to health department</li> </ul>	<ul style="list-style-type: none"> <li>· Treat TB patients and suspects with appropriate regimens, using DOT</li> </ul>	<ul style="list-style-type: none"> <li>· Evaluation of TST data for evidence of transmission</li> </ul>
<ul style="list-style-type: none"> <li>· Screen staff and long-term inmates for TB infection</li> </ul>	<ul style="list-style-type: none"> <li>· Offer prevention therapy to TST-positive persons when appropriate</li> </ul>	<ul style="list-style-type: none"> <li>· Assess completion of therapy and of preventive therapy</li> <li>· Evaluate success of referrals to health departments and other CFs</li> </ul>

Table 3.  
Essential TB Control Activities in Correctional Facilities

infection control program in the facility. These persons should be given the authority to develop, implement, enforce, and evaluate the TB infection control policies. All TB control personnel and clinicians who treat inmates or staff should be familiar with the special problems that correctional facilities may face in arriving at a diagnosis of TB. The strategic application of these interventions, however, should be based on the size and type of the facility, the length of stay of the facility's inmates, and the risk of TB infection and disease in the inmate population.

## Discussion

The incidence of TB disease has declined in recent years both in the total U.S. population and among correctional inmates, but TB incidence rates remain much higher among inmates than in the total population. With the overall national decline in TB cases, it has become clear that TB in this country is retreating into well-defined risk groups that can be targeted for control efforts. The Advisory Council for the Elimination of Tuberculosis (ACET) has recently published "Tuberculosis Elimination Revisited: Obstacles, Opportunities, and a Revised Commitment"<sup>(31)</sup>. This important document advocates for TB programs to develop and implement systems to conduct active case finding for TB among high- risk populations identified from analysis of local epidemiologic data. Given the fact that, for many geographic areas, correctional facility inmates significantly contribute to TB morbidity, concentration of TB control strategies on these populations will significantly decrease morbidity in those areas and overall. The complete implementation of policies such as those recommended by CDC (Tables 2 and 3) in its revised TB control guidelines for correctional facilities<sup>(29)</sup> will help reduce the incidence of TB in these settings. Key CDC recommendations include maintaining aggressive policies for screening inmates and staff for TB infection and TB disease, initiating and completing DOT anti-TB regimens, and using infection control measures to minimize transmission of *M. tuberculosis*. Better collection and reporting of screening data are needed to better define the magnitude of TB infection and disease among inmates and correctional workers, and to serve as an indicator of the success or failure of TB control programs, both in the

correctional facility and in the communities to which inmates return. Persons having problems with adherence to TB treatment regimens following their release from correctional facilities may be helped by better education, discharge planning, linkages with health departments and community-based providers, incentives to appear for follow-up appointments, and use of new ultra-short courses of therapy that may be completed before release.

## References

- Centers for Disease Control and Prevention. Reported Tuberculosis in the United States, 1998. August 1999;1-67.
- Valway SE, Greifinger RB, Papania M, Kilburn JO, Woodley C, DiFerdinando GT, Dooley SW. Multidrug-resistant tuberculosis in the New York State Prison System, 1990-1991. *J Infect Dis* 1994;170:151-156.
- Jones TF, Craig AS, Valway SE, Woodley CL, Schaffner W. Transmission of Tuberculosis in a Jail. *Ann Intern Med* 1999;131:557-563.
- Centers for Disease Control. Tuberculosis transmission in a state correctional institution - California, 1990-1991. *MMWR* 1992;41:927-929.
- Bock NN, Reeves M, LaMarre M, DeVoe B. Tuberculosis case detection in a state prison system. *Pub Health Rep* 1998;113:359-364.
- U.S. Department of Justice. 1996-1997 Update: HIV/AIDS, STDs, and TB in Correctional Facilities. July 1999:1-97.
- Lobato MN, Leary L, Hayden C, Simone PM. Treatment for TB Infection in Correctional Facilities, United States [Abstract]. In Programs and abstracts of the 30<sup>th</sup> IUATLD World Conference on Lung Health. International Union Against Tuberculosis and Lung Diseases. Madrid, Spain;1999.
- Salive ME, Vlahov D, Brewer TF. Coinfection with tuberculosis and HIV-1 in male prison inmates. *Pub Health Re.* 1990;105:307-310.
- Spencer SS, Morton AR. *Tuberculosis surveillance in a state prison system.* *AJPH* 1989;79:507-509.
- Centers for Disease Control. Tuberculosis prevention in drug-treatment centers and correctional facilities - selected U.S. sites, 1990-1991. *MMWR* 1993; 42:210-213.
- Alcabes P, Vossen P, Cohen R. Compliance with isoniazid prophylaxis in jail. *Am Rev Respir Dis* 1989; 140:1194-1197.
- Rider HL, Cauthen GM, Comstock GW, Snider DE Jr. Epidemiology of Tuberculosis in the United States. *Epidemiol Rev* 1989;11:79-98.

13. Selwyn PA, Hartel D, Lewis VA, Schoenbaum EE, Vermund SH, Klein RS, Walker AT, Friedland GH. A prospective study of the risk of tuberculosis among intravenous drug users with human immunodeficiency virus infection. *New Engl J Med* 1989;320:545-550.
14. Daley CL, Small PM, Schecter FG, Schoolnik GK, McAdam RA, Jacobs WR, Jr, Hopewell PC. An outbreak of tuberculosis with accelerated progression among persons infected with the human immunodeficiency virus. *New Engl J Med* 1992;326:231-235.
15. Braun MM, Truman BI, Maguire B, DiFerdinando GT, Wormser G, Broaddus R, Morse DL. Increasing incidence of tuberculosis in a prison inmate population -Association with HIV infection. *JAMA* 1989;261:393-397.
16. Glaser JB, Greifinger, RB. Correctional health care: a public health opportunity. *Ann Intern Med* 1993;118:139-45.
17. Survey of State Prison Inmates, 1991. Washington, DC: Bureau of Justice Statistics; March 1993. US Department of Justice document no. NCJ-136949.
18. Stead W. Undetected tuberculosis in prison. *JAMA* 1978;240:2544-7.
19. Centers for Disease Control and Prevention. Tuberculosis outbreaks in Prisons Housing Units for HIV-infected Inmates-California, 1995-1996. *MMWR* 1999;48:79-82.
20. Valway SE, Richards SB, Kovacovich J. Outbreak of multidrug-resistant tuberculosis in a New York State prison, 1991. *Am J Epidemiol* 1994;140(2):113-122.
21. Ikeda RM, Birkhead GS, DiFerdinando GT Jr, Bornstein DL, Dooley SW, Kubica GP, Morse DL. Nosocomial tuberculosis: an outbreak of a strain resistant to seven drugs. *Infect Control Hosp Epidemiol* 1995;16(3):152-159.
22. Ussery XT, Bierman JA, Valway SE, Seitz TA, DiFerdinando GT Jr, Ostroff SM. Transmission of multidrug-resistant *Mycobacterium tuberculosis* among persons exposed in a medical examiner's office, New York. *Infect Control Hosp Epidemiol* 1995;16(3):160-165.
23. Bellin EY, Fletcher DD, Sayfer SM. Association of tuberculosis infection with increased time in or admission to the New York City jail system. *JAMA* 1993;269:2228-31.
24. Pelletier AR, DiFerdinando GT, Greenberg AJ, Sosin DM, Jones WD, Bloch AB, Woodley CL. Tuberculosis in a correctional facility. *Arch Intern Med* 1993;153:2692-5.
25. Nolan CM, Roll L, Goldberg SV, Elarth AM. Directly observed isoniazid preventive therapy for released jail inmates. *Am J Respir Crit Care Med* 1997;155:583-586.
26. Layton MC, Henning KJ, Alexander TA, Gooding AL, Reid C, Heyman BM, Leung J, Gilmore DM, Frieden TR. Universal radiographic screening for tuberculosis among inmates upon admission to jail. *Am J Public Health* 1997;87:1335-1337.
27. American Correctional Association. Juvenile and adult correctional departments, institutions, agencies and paroling authorities. Laurel, Maryland: American Correctional Association, 1992: XXII.
28. Correctional Populations in the United States, 1991. Washington, DC: Bureau of Justice Statistics; August 1993. US Department of Justice document no. NCJ-1427-1429.
29. Centers for Disease Control and Prevention. Prevention and Control of tuberculosis in correctional facilities: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR* 1996;45(No. RR-8):1-27.
30. U.S. Department of Health and Human Services. Controlling TB in Correctional Facilities. Atlanta, Georgia: Centers for Disease Control and Prevention, 1995.
31. Centers for Disease Control and Prevention. Tuberculosis Elimination Revisited: Obstacles, Opportunities, and a Renewed Commitment. Advisory Council for the Elimination of Tuberculosis. *MMWR* 1999;48(No. RR-9):1-13.