

Controlling TB in Correctional Facilities



U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service



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1995

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Center for Prevention Services
Division of Tuberculosis Elimination
Atlanta, Georgia

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Contents

INTRODUCTION	
Purpose	1
Overview of Current Recommendations	1
Transmission of <i>M. tuberculosis</i>	4
Pathogenesis	5
Epidemiology of TB in Correctional Facilities	6
Definitions	11
SCREENING	
Screening Procedures	13
Diagnosis of TB Disease	22
Reporting Cases Identified Through Screening	28
CONTAINMENT	
Infection Control	31
Contact Investigation	35
Treatment	36
Preventive Therapy	43
ASSESSMENT	
General Guidelines	49
Evaluation of Possible Transmission Problems	50
Role of the Correctional Facility	51
Role of the Health Department	52
Endnotes	55
APPENDICES	59
1. Case Studies	
2. Screening Algorithms	
3. Treatment Tables	
4. Information Systems	
5. NCCHC Contact Information	

Abbreviations

ACET	Advisory Committee for the Elimination of Tuberculosis
AFB	acid-fast bacilli
AIDS	acquired immune deficiency syndrome
ATS	American Thoracic Society
BCG	bacille Calmette-Guérin
CDC	Centers for Disease Control and Prevention
CT	computed tomographic
DOPT	directly observed preventive therapy
DOT	directly observed therapy
EMB	ethambutol
HEPA	high-efficiency particulate air
HIV	human immunodeficiency virus
INH	isoniazid
MDR	multidrug-resistant
NCCHC	National Commission for Correctional Health Care
PCR	polymerase chain reaction
PPD	purified protein derivative
PZA	pyrazinamide
RIF	rifampin
SM	streptomycin
STD	sexually transmitted disease
TB	tuberculosis
TIMS	TB information management system
TU	tuberculin units
UVGI	ultraviolet germicidal irradiation

INTRODUCTION

Purpose

Controlling TB in Correctional Facilities is a comprehensive guide that provides a resource to assist federal, state, and local correctional officials in controlling tuberculosis (TB) among inmates and staff of correctional facilities. It is intended for use by health department staff and correctional medical and administrative officials to provide training and guidance for implementing TB control policies in federal, state, and local facilities. The case studies, screening algorithms, treatment tables, and sample forms for information management provided in the appendices are tools to be adapted to specific circumstances and needs. This resource is intended to encourage the collaboration and cooperation of health departments with the correctional facilities located in their jurisdictions.

This document is based on the latest ACET recommendations for the prevention and control of TB in correctional facilities.¹ The new recommendations have been updated and expanded to respond to the needs of short-term and long-term correctional settings. Two important resources used in the development of this guide are the “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994”² and the *Core Curriculum on Tuberculosis*.³

Overview of Current Recommendations

TB poses a unique challenge today in correctional environments, as inmate populations increase and overcrowding makes an outbreak of TB a serious threat. The following observations highlight the need for effective TB control in correctional facilities.

- TB is spread through the air. No voluntary actions are necessary to put persons at risk.
- A single highly infectious person can infect many others who share the same air.
- Immediate isolation of infectious patients can interrupt the transmission of *Mycobacterium tuberculosis*.
- Prompt initiation of directly observed therapy (DOT) with an adequate regimen diminishes infectiousness, reduces the risk of relapse, and helps prevent the development of drug-resistant strains.
- Persons infected with the human immunodeficiency virus (HIV), if they become infected with *M. tuberculosis*, are at very high risk for the development of TB disease.

- Directly observed preventive therapy (DOPT) with isoniazid (INH) can prevent the development of TB disease in infected persons who complete a prescribed regimen.
- Periods of incarceration offer a unique opportunity to provide preventive therapy or treatment to a high-risk population before their release into the community.

TB Control in CFs

Assign responsibility and authority for TB control activities

Plan, implement, and evaluate TB control activities

Coordinate with state and local health departments

Recent outbreaks in correctional facilities and an increase in both case rates and drug resistance rates in many areas of the United States have created an urgent need for systemwide improvement in correctional facilities' TB control efforts. The TB threat calls for innovative approaches by legislators, who can mandate necessary interventions and provide adequate funding for their implementation. It also calls for strong support from state and local health departments, which are ultimately responsible for TB control within their jurisdictions. Indeed, effective TB control in correctional facilities is necessary for the reduction of TB rates throughout the country and the eventual elimination of TB disease from the United States.⁴

tion of TB rates throughout the country and the eventual elimination of TB disease from the United States.⁴

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 and should designate a person or group of persons who will be responsible for the TB infection control program in the facility. These persons

Essential TB Control Activities in CFs

Screening

Containment

Assessment

should be given the authority to develop, implement, enforce, and evaluate TB infection control policies. TB control officials and all clinicians who treat inmates or staff should be familiar with the recommendations of the Advisory Council for the Elimination of Tuberculosis (ACET) concerning TB in correctional facilities, with other guidelines on TB published by the American Thoracic Society (ATS) and the Centers for Disease Control and Prevention (CDC), and with National Commission on Correctional Health Care (NCCHC) standards for correctional facilities. (See appendix 5 for more information on NCCHC.)

Correctional facility officials should form close working relationships with their state and local health departments. Health departments can assist correctional facilities in formulating, implementing, and evaluating essential TB control activities. These essential activities can be divided into three categories.

Screening refers to the following measures used to identify persons who have TB disease or TB infection:

1. Promptly identifying all persons in the system or facility who have suspected or confirmed TB disease and reporting the case or suspected case to the health department.
2. Identifying staff and long-term inmates who are infected with *M. tuberculosis* (i.e., those with positive skin tests) and evaluating them for preventive therapy.

Containment refers to the management of persons who have TB disease or infection to prevent the transmission of *M. tuberculosis*:

1. Placing persons suspected of having infectious TB disease in an appropriate TB isolation room immediately, and promptly carrying out a thorough contact investigation if an exposure has occurred.
2. Promptly initiating adequate therapy for persons who have suspected or confirmed TB disease, using DOT for all patients. (See p. 37.)
3. Evaluating persons who have TB infection, especially those in high-risk groups, and offering preventive therapy when appropriate. Preventive therapy given in correctional facilities should be directly observed.

Effective Strategies

Because risk is high, CFs must use effective TB control strategies:

- Isolate infectious patients promptly
- Ensure that patients complete treatment using DOT
- Give DOPT to high-risk persons who have TB infection

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
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
 - referrals to health departments or other correctional facilities are made in a timely fashion and confirmed

All correctional facilities should have a TB control plan that includes these three essential activities; however, the strategic application of these interventions will depend 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.

Transmission of *M. tuberculosis*

TB is caused by bacteria in the *M. tuberculosis* complex, also known as tubercle bacilli. TB is spread from person to person through the air. When a person with pulmonary or laryngeal TB coughs, sings, laughs, or sneezes, tiny particles containing *M.*

tuberculosis are expelled into the air. These tiny particles, or droplet nuclei, are only 1-5 microns in diameter and can remain suspended in the air for several hours. If another person inhales droplet nuclei containing *M. tuberculosis*, transmission may occur.

High-Risk Populations

TB infection is common in

- close contacts of persons with infectious TB
- persons who inject drugs
- persons born in countries where TB is common
- low-income persons with poor access to health care

Persons at the highest risk of becoming infected with *M. tuberculosis* are close contacts—persons who spend a significant amount of time with someone who has infectious TB disease. These persons are at risk for TB infection because they are more likely to be exposed to droplet nuclei containing tubercle bacilli. Infection rates have been relatively stable since 1987, ranging from 21% to

23% of the contacts of infectious TB patients. The probability that TB will be transmitted depends on three factors:

1. the infectiousness of the person with TB
2. the environment in which exposure occurred
3. the duration of exposure

The best way to stop transmission is to isolate patients who have infectious TB immediately and to start effective TB therapy. In most cases, infectiousness declines very rapidly after adequate therapy is started, as long as the patient adheres to the prescribed regimen. (See p. 31 for more information on infectiousness.)

For contacts of persons who have drug-resistant TB, infection rates seem to be similar. However, patients with drug-resistant disease are often infectious for longer periods because their response to treatment may be poor; such patients therefore have the potential to infect more contacts. Infection rates are much lower for extrapulmonary TB, which is rarely contagious, than for pulmonary or laryngeal TB; however, transmission from extrapulmonary sites has been reported during aerosol-producing procedures, such as autopsies and tissue irrigation.

Pathogenesis

When a person inhales air containing particles expelled by an infectious person, most of the larger particles become lodged in the upper respiratory tract, where infection is unlikely to develop. However, some droplet nuclei containing tubercle bacilli may reach the lower parts of the lungs, where infection begins. Initially, the tubercle bacilli multiply in the alveolar macrophages. A small number spread through the lymphatic channels to regional lymph nodes and then through the bloodstream to more distant tissues and organs, including areas in which TB disease is most likely to develop: the apices of the lungs, the kidneys, the brain, and bone.

Within 2 to 10 weeks after infection, the immune system usually intervenes, halting the multiplication of the tubercle bacilli and preventing further spread. Most infected people have a positive reaction to the tuberculin skin test at this time. (The tuberculin skin test is used to identify persons who are infected with *M. tuberculosis*.) Persons with a positive skin test reaction who do not have TB disease cannot infect others. TB infection in a person who does not have TB disease is not considered a case of TB and is often referred to as latent TB infection.

TB infection progresses to disease when the tubercle bacilli begin to multiply. Infection can progress to disease a few weeks or many years after infection. In the United States, in approximately 5% of persons who are infected with *M. tuberculosis*, TB disease will develop in the first year or two after infection. In another 5%, disease will develop later in their lives. In other words, in approximately 10% of persons infected with *M. tuberculosis*, disease will develop at some point. The remaining 90% will stay infected, but free of disease, for the rest of their lives.

Some medical conditions increase the risk that TB infection will progress to disease. (See p. 23.) The risk may be approximately 3 times greater (as with diabetes mellitus) to more than 100 times greater (as with HIV infection) for persons who have these conditions than for those who do not. Compared with immunocompetent persons who are infected with *M. tuberculosis*, infected persons who are immunosuppressed are at considerably greater risk for the development of TB disease.

General systemic symptoms of TB disease include weight loss, night sweats, fever, chills, easy fatigability, and loss of appetite. Other symptoms of TB depend on the site of disease. The lungs are the most common site for TB disease; approximately 85% of

High-Risk Populations

TB infection is more likely to progress to TB disease in

- HIV-infected persons
- persons who inject drugs
- persons recently infected with *M. tuberculosis*
- persons with certain medical conditions

TB cases are pulmonary. Patients with pulmonary TB disease usually have a productive, prolonged cough and sometimes have chest pain or cough up blood. Such persons usually have an abnormal chest radiograph, and they should be considered infectious.

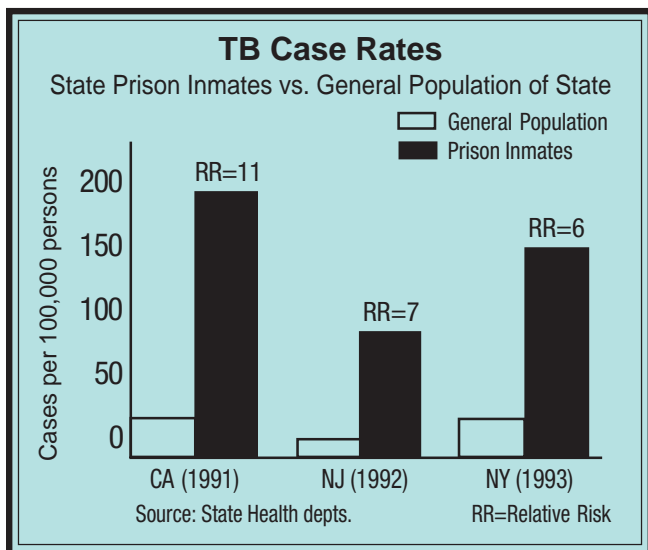
TB may also occur in the central nervous, lymphatic, or genitourinary systems; in the bones and joints; as a pleural effusion; or as disseminated disease (miliary TB). Extrapulmonary TB is more common in persons who have HIV infection than in persons who do not. Lymphatic TB and miliary disease are particularly common in HIV-infected persons. Extrapulmonary TB is often accompanied by pulmonary TB in this group.

Among persons who have both TB infection and HIV infection, the likelihood that TB infection will progress to TB disease is estimated to be 8% to 10% **per year**, compared with a lifetime risk of 10% for persons with TB infection but no HIV infection. In the presence of HIV infection, TB disease can develop in either of two ways. First, in a person who first has TB infection and later becomes infected with HIV, TB disease can develop as the immune system weakens. Second, in a person who first has HIV infection and later becomes infected with *M. tuberculosis*, the progression of TB infection to TB disease is often very rapid.⁵

Epidemiology of TB in Correctional Facilities

TB is a recognized problem in correctional facilities nationwide. In recent years, dramatic increases in TB cases have been reported in correctional facilities in some geographic areas of the United States. Among inmates of the New York State correctional system, for example, the incidence of TB disease increased from 15.4 per 100,000 in the period 1976-1978 to 105.5 per 100,000 in 1986.⁶ By 1993, this incidence rate

was 139.3 per 100,000 (New York State Department of Health, unpublished data). Also, in many areas the unadjusted case rates for prison populations are markedly higher than rates for the general population. The 1993 TB case rate of 139.3 per 100,000 in the New York State correctional system was more than six times the case rate of 21.7 per 100,000 for the general population of New York State (New York State Department of Health, unpublished data). Similarly, in New Jersey the incidence of TB disease among state inmates in 1992 was 91.3 per 100,000, compared with 12.6 per 100,000 for the state's general population in the same year.⁷ And 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. Transmission of *M. tuberculosis* was also documented in this California prison.⁸

In 1993, as part of expanded national TB case reporting, state health departments began to report to CDC whether newly diagnosed TB patients were residents of correctional facilities at the time of diagnosis. A total of 48 reporting areas (47 states and New York City) provided this information for 75% or more of their cases. In these areas, 3.8% of TB patients for whom information on correctional facility status was reported were residents of a correctional facility at the time of diagnosis;⁹ in 1994, 4.6% of TB patients in 51 reporting areas (48 states, New York City, the District of Columbia, and Puerto Rico) were reported as residents of a correctional facility at the time of diagnosis.¹⁰ Table 1 summarizes, for each reporting area, the percentage of TB patients who were reported as residents of a correctional facility at the time of diagnosis in 1994.

Several studies have demonstrated a high prevalence of TB infection among inmates, ranging from 14% to 25%.^{11,12,13,14} Other studies have shown a correlation between tuberculin skin test positivity rates and length of time in prison, indicating that transmission may have occurred within correctional facilities.^{15,16}

Risk Factors for TB Infection and Disease

There are numerous reasons for the high risk for TB infection and disease in correctional facilities. Many inmates come from groups that have a high rate of infection with *M. tuberculosis*, such as persons who inject drugs and medically underserved, low-income populations. Others have risk factors for the development of TB disease if infected, such as infection with HIV.

HIV infection is the strongest known risk factor for the development of TB disease among adults who have latent TB infection.^{17,18} The prevalence of HIV infection and AIDS among inmates has increased significantly during the past decade, and the annual incidence of AIDS among prisoners is

TB Infection in CFs

Prevalence of TB infection ranges from 14% to 25%

Skin test positivity correlates with length of time in prison

HIV Infection and TB

Persons coinfecting with HIV and *M. tuberculosis* are at very high risk for the development of TB disease

Their risk is 8% to 10% each year vs. a 10% lifetime risk for persons infected only with *M. tuberculosis*

Controlling TB in Correctional Facilities

Table 1. TB Cases Reported as Residents of Correctional Facilities (CF) at the Time of Diagnosis: 59 Reporting Areas, 1994

Reporting Area	Total Cases Reported	Cases with Information on CF Residence		Percent of Total Cases in CF Residents (a)
		No.	%	
United States	24,361	23,161	95.1	4.6 (b)
Alabama	433	433	100.0	2.5
Alaska	93	89	95.7	1.1
Arizona	249	241	96.8	2.5
Arkansas	264	261	98.9	7.3
California	4,859	4,827	99.3	4.8
Colorado	94	93	98.9	3.3
Connecticut	148	148	100.0	4.1
Delaware	57	55	96.5	1.8
District of Columbia	121	113	93.4	6.2
Florida	1,762	1,237	70.2	—
Georgia	740	732	98.9	3.3
Hawaii	247	246	99.6	0.0
Idaho	13	11	84.6	9.1
Illinois	1,117	953	85.3	3.5
Indiana	211	209	99.1	3.3
Iowa	66	56	84.8	5.4
Kansas	84	79	94.0	5.1
Kentucky	347	342	98.6	2.6
Louisiana	433	428	98.8	4.2
Maine	35	35	100.0	0.0
Maryland	363	363	100.0	1.1
Massachusetts	329	328	99.7	1.5
Michigan	462	421	91.1	1.4
Minnesota	140	139	99.3	2.2
Mississippi	278	278	100.0	1.8
Missouri	260	254	97.7	4.3
Montana	24	24	100.0	0.0
Nebraska	22	22	100.0	0.0
Nevada	126	126	100.0	2.4
New Hampshire	17	17	100.0	5.9
New Jersey	855	850	99.4	3.5
New Mexico	81	80	98.8	0.0
New York State (c)	641	556	86.7	12.2
New York City	2,995	2,983	99.6	3.2
North Carolina	566	566	100.0	2.3
North Dakota	10	10	100.0	20.0
Ohio	337	332	98.5	3.3
Oklahoma	261	239	91.6	5.0
Oregon	165	165	100.0	2.4
Pennsylvania	621	605	97.4	4.0
Rhode Island	56	56	100.0	1.8
South Carolina	387	387	100.0	1.8
South Dakota	28	28	100.0	0.0
Tennessee	520	504	96.9	4.0
Texas	2,542	2,541	100.0	11.5
Utah	55	55	100.0	5.5
Vermont	10	9	90.0	0.0
Virginia	372	175	47.0	—
Washington	264	264	100.0	1.1
West Virginia	80	80	100.0	0.0
Wisconsin	109	104	95.4	0.0
Wyoming	12	12	100.0	0.0
American Samoa (d)	5	5	100.0	0.0
Fed. States of (d)	63	44	69.8	—
Micronesia				
Guam (d)	21	21	100.0	0.0
N. Mariana Islands (d)	14	14	100.0	0.0
Puerto Rico (d)	274	266	97.1	1.9
Republic of Palau (d)	26	26	100.0	0.0
U.S. Virgin Islands (d)	10	9	90.0	0.0

(a) Resident of CF at time of diagnosis. Percentages shown only for reporting areas with information reported for $\geq 75\%$ of cases.

(b) Percentage based on data from 50 areas reporting information on residence in CF for $\geq 75\%$ of cases.

(c) Excludes New York City.

(d) Not included in totals.

markedly higher than the incidence among the general U.S. population. In the New York State prison system, AIDS cases increased steadily from 3 cases in 1981 (43 cases per 100,000 inmates) to 228 cases in 1987 (574 cases per 100,000 inmates).¹⁹

According to Department of Justice statistics for 1991, 0.2% of the total prison population had confirmed AIDS. At that time, every state correctional system had reported at least 1 case of AIDS.²⁰ Between January 1991 and December 1992, CDC conducted a blind HIV seroprevalence survey that included over 70,000 blood samples from persons entering adult correctional facilities across the country. Among inmates of these facilities, the overall median HIV seroprevalence was 2.9% (range, 0% to 14.9%). In contrast, the overall HIV seroprevalence among civilian applicants for military service in 1991 and 1992 was 0.06%.²¹

HIV infection in inmates is primarily associated with a history of drug injection, which is more common among inmates than among the general population.²⁰ In a 1991 survey of more than 20,000 state and federal prisoners in 45 states, 25% of the inmates reported a history of drug injection.²² Through unknown mechanisms, persons who inject illicit drugs may be at increased risk for TB even if not infected with HIV.²³ In addition, the use of crack cocaine has been associated with the transmission of HIV and *M. tuberculosis*.^{24,25} In the 1991 inmate survey, 19.8% of state and federal prisoners reported a history of crack cocaine use.²² But even in the absence of HIV infection and drug use, the inmate population is still at a relatively high risk for TB, because a disproportionately high number of inmates come from lower socioeconomic groups with poor access to health care and a high prevalence of TB infection.²⁶

Another significant reason for the high risk of TB in correctional facilities is the overcrowded environment in many of these facilities—an environment conducive to the transmission of

Drug Use and TB

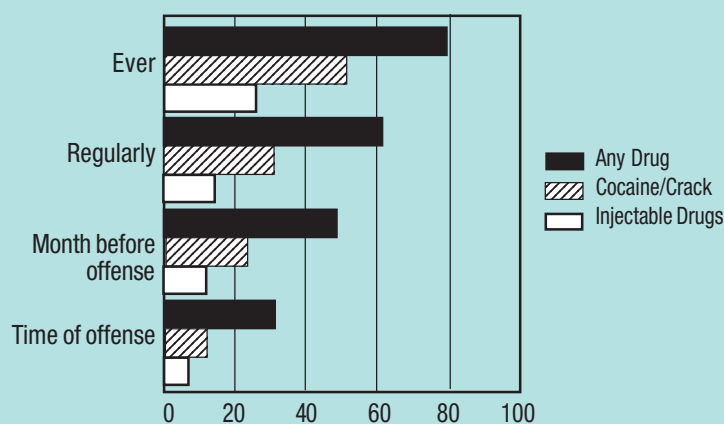
Persons who inject drugs

- are at high risk for HIV infection
- are at high risk for TB disease if infected with *M. tuberculosis*

Crack cocaine use has been associated with transmission of HIV and *M. tuberculosis*

Drug Use by Inmates

By Frequency of Use



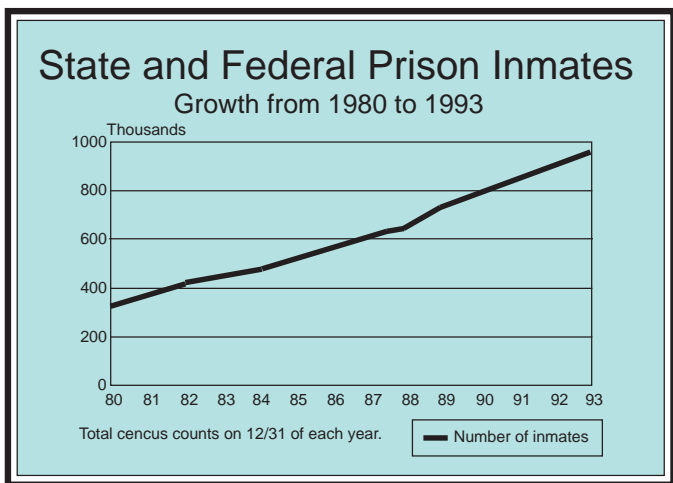
*Data from 1991 Survey of State Prison Inmates, Bureau of Justice Statistics

M. tuberculosis.^{16,27} In the 1992 Annual Survey of Jails, the jails surveyed were found to be operating at 99% of their rated capacity. In June 1990, state correctional facilities were 22% above design capacity; federal facilities were 46% above capacity.²⁸ At that time, 186 state correctional facilities (approximately 1 in every 7) were under state or federal court order or consent decree for specific conditions relating to crowding.²⁹ Poor ventilation, which is a problem in many facilities, can also promote the transmission of *M. tuberculosis* to inmates, staff, and visitors.^{16,27}

Populations at Risk for TB in Correctional Facilities

A growing number of persons either work in or are confined in correctional facilities in the United States. In 1989, the United States incarcerated a greater percentage of its

population than any other country: for every 100,000 persons, 426 were confined in prisons and jails.³⁰ Between 1980 and 1993, the number of prisoners in federal and state correctional facilities almost tripled, from 329,821 in 1980 to 948,881 in 1993.³¹ At midyear 1994, this number had increased to 1,012,851 (Department of Justice, unpublished data). Among this growing inmate population, recidivism is a common problem; in the 1991 survey of state prison inmates, 61% reported a previous incarceration.²² Further expansion of correctional systems throughout the country is foreseen as the result of new legislation to reduce crime.



The transmission of *M. tuberculosis* in correctional facilities presents a health problem for inmates and for the communities into which they are released. Overall in 1991, a total of 9,929,347 persons were released from U.S. jails, and 436,991 sentenced prisoners were released from state or federal jurisdiction.³² Infected inmates who become sick with TB disease may infect others, including young children, after their release.³³ In a 1991 survey of more than 20,000 state and federal inmates, 56% of male and 67% of female inmates reported having at least one child. Moreover, 6% of nearly 39,000 female inmates were pregnant when they entered prison.²² Additionally, correctional employees are at risk for occupational exposure to TB.

In several recent outbreaks of TB in correctional facilities, the failure to detect TB disease among inmates resulted in the transmission of *M. tuberculosis* to inmates, correctional staff, or persons in the community (CDC, unpublished data). Of particular concern are reports of outbreaks in New York and California that involved the transmission of multidrug-resistant (MDR) strains of *M. tuberculosis* to inmates and staff of

a correctional facility and, in New York, to health care workers and patients in a nearby hospital.^{34,35}

These data underscore the need for effective TB control policies in correctional facilities. Yet according to a recent survey of 82 correctional systems, policies for TB control in some correctional facilities do not meet CDC's recommended standards of care.³⁶ Many correctional facilities have comprehensive written protocols for TB control, but there are no data on the extent to which these protocols are put into practice. The need for improved correctional health care was cited in a recent position paper by the American College of Physicians, the NCCHC, and the American Correctional Health Services Association,³⁷ as well as in a 1993 article by Glaser and Greifinger.³⁸ Furthermore, a number of recent court cases have upheld a constitutional right to adequate TB control in correctional facilities, holding that inadequate TB control efforts constitute deliberate indifference to the medical needs of inmates.³⁶

Importance of Control Measures

TB control policies in some CFs do not follow CDC's current guidelines

No data are published on the appropriateness and effectiveness of TB control practices in CFs

Inadequate TB control efforts may be interpreted as deliberate indifference to medical needs of inmates

Definitions

Controlling TB in Correctional Facilities uses the following terms, which are also defined in the ACET recommendations for correctional facilities.

DOT — therapy in which a health care worker, specially trained correctional officer, or health department employee watches the inmate swallow each dose of medication.

Inmate — any prisoner, detainee, or other resident of a correctional facility, whether adult or juvenile, sentenced or unsentenced.

Long-term facilities — state and federal prisons, juvenile facilities, and some jail facilities that house predominately long-term inmates, many of whom have been tried and sentenced.

Long-term inmate — an inmate who will remain in custody for a period of 14 days or longer.

Negative pressure — a difference in air pressure between a corridor and a TB isolation room that causes a one-way flow of air into the isolation room; this prevents contaminated air from leaving the isolation room and entering other parts of the facility.

Inmates

Long-term inmate: an inmate who will remain in custody for 14 days or longer

Short-term inmate: an inmate who will remain in custody for less than 14 days (especially pretrial detainees)

Short-term facilities — jails, detention centers, and holding pens that house predominately short-term inmates, many of whom are awaiting trial or serving brief sentences. Police lockups are also included in this category.

Short-term inmate — an inmate who remains in custody for less than 14 days, especially pretrial detainees likely to be released without supervision or placed in the community under court supervision.

Suspected TB case — an illness episode for which the diagnosis is being strongly considered, but the diagnostic evaluation is not complete. A person who is suspected of having TB usually has signs and symptoms compatible with TB (i.e., productive or prolonged cough [lasting for 3 weeks or more], chest pain, coughing up blood, weight loss, night sweats, fever, chills, easy fatigability, loss of appetite).

TB case — a particular episode of clinically active TB, usually confirmed by a positive culture for *M. tuberculosis*. This term should be used to refer only to the disease itself, not the patient with the disease. By law, suspected or confirmed cases of TB must be reported to the state or local health department.

TB disease — a clinically active disease state that is caused by organisms of the *M. tuberculosis* complex, which are sometimes referred to as the tubercle bacilli. Persons who have TB disease usually have symptoms, which differ according to the site of disease.

TB infection — a condition in which a relatively small number of living tubercle bacilli (*M. tuberculosis*) are present in the body but are not multiplying or causing clinically active disease. Infected persons usually have positive tuberculin skin test reactions, but they have no symptoms related to the infection and are not infectious.

TB isolation room — a single-patient room with special ventilation characteristics appropriate for the purposes of isolating patients who have infectious TB disease, as described in Supplement 3 of the “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994.”² To prevent the escape of droplet nuclei, TB isolation rooms should be maintained under negative pressure, which should be monitored daily while the room is being used for TB isolation.

SCREENING

Screening Procedures

Two types of screening should be carried out in a correctional facility:

1. Screening to identify persons who may have infectious TB disease so they can be isolated immediately and started on appropriate therapy
2. Screening to identify infected persons who are at high risk for the development of TB disease and who would benefit from preventive therapy

The success of all screening activities depends on effectively identifying all such persons, providing them with appropriate follow-up care and treatment, and ensuring that they complete a full course of recommended therapy.

Screening

- Promptly identify persons who have confirmed or suspected TB disease
- Report confirmed or suspected TB cases to health department
- Screen staff and long-term inmates for TB infection

Screening Methods

The following methods are commonly used to detect TB infection or TB disease; further details about these methods can be found in the ATS-CDC document “Diagnostic Standards and Classification of Tuberculosis.”³⁹

Symptom screening. Screening for symptoms of TB disease is the first line of defense in situations in which the incidence or prevalence of TB disease is high. The symptoms of pulmonary TB may include

- productive, prolonged cough (lasting for 3 weeks or more)
- chest pain
- coughing up blood (hemoptysis)

Cough is the most common symptom of pulmonary TB. Chest pain and hemoptysis occur less frequently and in more advanced cases. Persons who have any of these symptoms may be infectious. When infectious TB is suspected, precautionary TB isolation should be initiated until a diagnostic evaluation rules out infectious TB disease. (For more information on diagnosis, see p. 22; on infection control, p. 31.)

The index of suspicion for TB disease should be high when pulmonary symptoms are accompanied by general systemic symptoms of TB, including

- weight loss
- night sweats, fever, or chills
- easy fatigability
- loss of appetite

Screening Methods Symptom Screening

Interview systematically to determine whether person has experienced

- productive, prolonged cough
- coughing up blood
- chest pain
- weight loss or loss of appetite
- fever, night sweats, or chills

If symptoms present, evaluate for TB disease

On entry into a facility, inmates should be interviewed systematically to determine whether they have experienced any of the above symptoms in the past few weeks. Persons with symptoms suggestive of TB should immediately receive a thorough medical evaluation, including a tuberculin skin test, and, if pulmonary involvement is suspected, a chest radiograph and sputum examinations to detect acid-fast bacilli (AFB).

As part of their regular medical evaluation, inmates should be asked if they have a history of TB disease or of treatment or preventive therapy for TB. This information should be

noted in their medical record. Any inmate with a history of inadequate treatment for TB disease should undergo a thorough medical evaluation and should be strongly considered for preventive therapy (if TB disease is ruled out).

Chest radiograph screening. Screening for TB disease with a chest radiograph is appropriate when the incidence or prevalence of TB disease is high. Chest radiograph screening is a quick and effective way to identify and immediately isolate potentially

infectious persons. A posterior-anterior view of the chest is the standard radiograph initially needed to detect and describe chest abnormalities. Occasionally, other views (e.g., lateral, apical lordotic) or additional studies (e.g., computed tomographic [CT] scans) may be necessary for further evaluation. When chest radiograph films are taken of women who may be pregnant, lead shielding should be used to protect the pelvic and abdominal area.

Screening Methods Chest X-ray

- Use to screen for TB disease when risk of transmission is high
- Take posterior-anterior view
- If abnormalities present, examine sputum and evaluate further

Chest radiographs can be used to identify persons who may have pulmonary TB but

who have no symptoms of disease. Chest radiograph interpretations for asymptomatic persons should be available within 72 hours. Whenever possible, radiography should be performed on site to avoid delays in diagnosis. All inmates with pulmonary abnormalities should have at least three sputum smears and culture examinations, regardless of their skin test results. (See p. 25 for information on the interpretation of chest radiographs.)

Mantoux tuberculin skin test screening. The preferred method of screening for TB infection is the Mantoux tuberculin skin test. Because multiple puncture tests give variable results and are not standardized, they should not be used to determine whether a person is infected with *M. tuberculosis*. Persons who have a documented positive skin test result, a documented history of TB disease, or who report a history of a severe necrotic reaction to tuberculin should be exempt from routine tuberculin skin test screening. These persons should receive a chest radiograph on initial screening unless they have documentation of a previously completed course of preventive therapy or treatment. Bacille Calmette Guérin (BCG) vaccination, pregnancy, and lactation are not contraindications for tuberculin skin testing.

The tuberculin skin test is not a good method of screening for TB disease; on average, 10% to 25% of patients with TB disease have a negative reaction to the tuberculin skin test.^{40,41,42} In addition, recent live-virus vaccination (e.g., measles, mumps, polio) can potentially cause a false-negative tuberculin skin test reaction; therefore, skin testing should not be done at the same time as or immediately following live-virus vaccination.

How to Perform the Mantoux Tuberculin Skin Test

- Perform the Mantoux test by giving an intradermal injection of 0.1 ml of 5 tuberculin units (TU) of purified protein derivative (PPD) tuberculin into either the volar or dorsal surface of the forearm. (The 5 TU dose has been adopted as the standard screening dose; other concentrations of antigen should not be used.)
- Inject the tuberculin with a disposable tuberculin syringe, just beneath the surface of the skin with the needle bevel facing upward. This should produce a discrete, pale elevation of the skin (a wheal) 6 mm to 10 mm in diameter.
- To prevent needlestick injuries, do not recap needles, bend or break them, remove them from disposable syringes, or otherwise manipulate them by hand.
- After disposable needles and syringes have been used, place them in puncture-resistant containers for disposal. Follow institutional guidelines regarding universal precautions for infection control (e.g., the use of gloves).

An experienced health care worker should read the reaction to the Mantoux test 48 to 72 hours after the injection. If the patient fails to show up for the scheduled reading, positive reactions may still be measurable up to 1 week after testing.⁴³ However, if a patient who returns after 72 hours has a negative test, tuberculin testing should be repeated. The area of induration (palpable swelling) around the site of injection is the reaction to tuberculin. The diameter of the indurated area should be measured across the forearm. Erythema (redness) should not be measured. All reactions should be recorded in millimeters of induration, even those classified as negative. If no induration is found, “0 mm” should be noted. Persons with a positive skin test reaction and no symptoms suggestive of TB should receive a chest radiograph within 72 hours of the skin test reading. (Persons with symptoms suggestive of TB disease should be evaluated immediately, as discussed on p. 14.)

Two-step tuberculin skin test screening. In some persons who are infected with *M. tuberculosis* (especially persons who were infected many years ago), delayed-type hypersensitivity to tuberculin may wane over the years. When these people are

skin tested many years after infection, they may have a negative reaction. However, this skin test may stimulate their ability to react to tuberculin, causing a positive reaction to subsequent tests. This boosted reaction may be misinterpreted as new infection.

Screening Methods Two-Step PPD Skin Test

Use for baseline testing of persons who will periodically receive tuberculin skin tests

If reaction to first test negative, do second test to ensure that first reaction was not false negative

Boosted reactions are more common in persons infected many years ago and persons vaccinated with BCG

Two-step testing should be used for the **baseline testing** of persons participating in an institutional skin testing program. It is done to distinguish a new infection from a boosted reaction. If the reaction to the first test is positive, the person is considered infected with *M. tuberculosis* and no further skin testing is required. If the first test is

negative, a second test should be done 1 to 3 weeks later. (Some institutions wait until 1 week after the first test to read the reaction to the first test and administer the second test to tuberculin-negative inmates, thus eliminating one appointment. The reaction to the second test should be read 48 to 72 hours after the injection.)

A positive reaction to the second test probably represents a boosted reaction and is **not** considered a skin test conversion. A positive reaction to the second test almost always means that person was infected sometime in the past. Persons with a positive reaction to the second test should be evaluated for preventive therapy (if TB disease is ruled out). Persons with a negative reaction to the second test should be classified as uninfected. In persons with a negative reaction to the second test, a positive reaction to any subsequent test is likely to represent new infection with *M. tuberculosis* (a skin test conversion).

Initial Screening

All correctional facilities without an adequate TB isolation room should have a written plan to refer patients with suspected or confirmed TB to a collaborating facility that is equipped to evaluate and treat patients who have TB. The following procedures should be used for the initial screening of inmates, depending on their length of stay in the facility and the type of facility, and for all correctional staff, regardless of the type of facility. (See screening algorithms, appendix 2.)

Inmates in long-term facilities. Symptom screening should be done as soon as possible for all new inmates. Any inmate with symptoms suggestive of TB should be immediately placed in a TB isolation room and promptly evaluated for TB disease. In addition, tuberculin skin test screening of all inmates without a documented positive Mantoux skin test result should be mandatory in long-term correctional facilities.

Decisions about the use of two-step skin testing for inmates on entry should be based on the frequency of boosting in the facility; in some facilities, this may provide a more reliable baseline. To decide whether routine two-step testing is necessary in a particular inmate population, it is important to determine initially how many persons with boosted reactions are identified by this method (especially given the logistical and practical problems of implementing a two-step testing program and the added cost of the second test).

Persons with a positive skin test reaction should receive a chest radiograph, a thorough medical evaluation, and consideration for preventive therapy (if TB disease is ruled out). Inmates known to have HIV infection, as well as inmates who are at risk for HIV infection but whose HIV status is unknown, should have a chest radiograph as part of initial screening, regardless of their tuberculin skin test status.⁴

Inmates in short-term facilities serving populations at high risk for TB.

As above, symptom screening should be done as soon as possible for all new inmates.

Initial Screening Long-Term Facilities

Skin-test all inmates (except those with documented positive result)

Use two-step skin testing initially if boosting is common

Use chest x-ray to screen inmates known to have or at risk for HIV infection (regardless of skin test result)

Initial Screening Short-Term Facilities Serving High-Risk Populations

In large jails, consider on-site chest x-ray screening for all inmates

Skin-test long-term inmates within 14 days of entry

Use chest x-ray to screen all inmates known to have or to be at risk for HIV infection

Any inmate with symptoms suggestive of TB should be placed in a TB isolation room immediately and promptly evaluated for TB disease. Tuberculin skin test screening generally is not feasible for short-term inmates. However, long-term inmates in short-term facilities who do not have a documented positive skin test result should be tuberculin tested within 14 days of entry.

Persons with a positive skin test reaction should receive a chest radiograph, a thorough medical evaluation, and consideration for preventive therapy (if TB disease is ruled out). Inmates known to have HIV infection, as well as inmates who are at risk for HIV infection but whose HIV status is unknown, should have a chest radiograph as part of the initial screening, regardless of skin test results.

**Initial Screening
Short-Term Facilities Serving Low-
Risk Populations**

Assess risk of TB in facility

More extensive screening not indicated if facility and community served have

- minimal risk of TB disease
- no drug-resistant TB disease
- low prevalence of HIV infection

To prevent transmission in some large jails, TB control officials should consider using on site chest radiography to screen all inmates for TB disease at entry into the facility. Such screening is particularly important for jails with a very high incidence of TB disease, a rapid turnover of inmates, and a high prevalence of HIV infection and drug injection. Jail officials should consult the local TB control officer for assistance in assessing the need for, and the cost-effectiveness of, such screening. In jails where chest radiograph screening is initiated for all new entrants, long-term inmates should also be tuberculin skin tested (as explained previously).

Although it may be difficult to know in advance which inmates will remain in the facility for 14 days or longer, staff should arrange medical screening according to a screening protocol. Symptom screening and other procedures recommended for short-term inmates should be performed immediately on entry with the usual receiving screening. Procedures recommended for long-term inmates should be performed with a full health assessment, “as soon as possible after arrival and in consideration of results from the receiving screening process, but no later than 14 calendar days after the inmate arrives at the jail.”⁴⁴

Inmates in short-term facilities serving populations at low risk for TB.

Symptom screening at entry is recommended for all inmates. Any inmate with symptoms suggestive of TB should be placed in a TB isolation room immediately and promptly evaluated for TB disease. As with other types of facilities, it is essential that short-term facilities serving low-risk populations have a written plan to refer patients

with suspected or confirmed TB to a collaborating facility that is equipped to evaluate and treat patients who have TB.

A decision not to institute more extensive TB screening in short-term facilities should be supported by a thorough assessment of the risk of TB in the facility. For example, in some facilities serving low-risk populations, the risk for exposure to and transmission of *M. tuberculosis* is minimal, and screening for infection with *M. tuberculosis* may not be indicated. A minimal risk facility (1) does not house TB patients, (2) is not located in a community with TB, and (3) does not house inmates from communities with TB. (A community with TB is a county or community in which TB cases have been reported during the previous year). Thus, there is essentially no risk for exposure to TB patients in the facility. More extensive TB screening (e.g., chest radiograph screening, Mantoux tuberculin skin test screening) may be warranted if there is drug-resistant TB in the facility or community, or a relatively high prevalence of HIV infection among inmates or staff.

Staff members in all correctional facilities. A medical history should be taken during a physical examination of all staff on hiring. In addition, tuberculin skin test screening (at hiring and annually thereafter) should be mandatory for all staff without a documented positive skin test result. To improve the accuracy of the baseline result, two-step Mantoux tuberculin skin testing should be used for the initial screening of staff. Persons who have had a documented negative skin test result in the past 12 months need only one additional skin test on hiring.

Persons who have a positive skin test reaction should receive a chest radiograph, a thorough medical evaluation, and consideration for preventive therapy (if TB disease is ruled out). All staff should be informed that if they are immunosuppressed for any reason they should see their medical practitioner for appropriate follow-up and screening for TB (e.g., a chest radiograph for HIV-infected persons, regardless of skin test results). Any staff member who has symptoms suggestive of TB should be sent home immediately and should not return to work until infectious TB disease has been ruled out.

Minimal risk correctional facilities may not need to maintain an ongoing PPD skin-testing program for staff. There is essentially no risk for exposure to TB patients when a facility (1) does not house TB patients, (2) is not located in a community with TB, and (3) does not house inmates from communities with TB. (A community with TB is a

Initial Screening CF Staff

Take a medical history upon hiring

Skin-test all staff (except those with documented positive result)

Use two-step testing initially

Inform all staff of increased risk of TB for immunocompromised persons

Interpreting Skin Test Results

A reaction of ≥ 5 mm is considered positive for

- close contacts
- persons with chest x-ray suggestive of previous TB
- persons known to have HIV infection
- persons at risk for HIV infection but whose HIV status is unknown (including persons who inject drugs)

county or community in which TB cases have been reported during the previous year.)

However, baseline PPD testing of health care workers may be advisable so that if an unexpected exposure does occur, conversions can be distinguished from positive PPD test results caused by previous exposures.

Medical facilities within correctional facilities. Medical facilities within correctional facilities should conduct a thorough risk assessment and follow the recommendations outlined in the “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994.”²

Interpretation of Mantoux Tuberculin Skin Test Results

Generally, a tuberculin skin test reaction of **10 mm or greater** of induration is considered positive for inmates and staff of correctional facilities. However, a reaction of 5 mm or greater is considered positive for

- persons known to have HIV infection
- persons at risk for HIV infection (including persons who inject drugs) but whose HIV status is unknown
- close contacts of a person with infectious TB
- persons who have chest radiograph findings suggestive of previous TB

Immunization with BCG, a vaccine for TB disease that is used in many countries, can cause a positive reaction to the tuberculin skin test. There is no reliable method of distinguishing tuberculin reactions caused by BCG from those caused by infection with *M. tuberculosis*. However, a reaction to tuberculin in a person with a history of BCG

vaccination is more likely to be due to infection with *M. tuberculosis* if **any** of the following are true:

- the induration is large
- the person was vaccinated a long time ago
- the person is a recent contact of a person with infectious TB
- there is a family history of TB
- the person comes from an area of the world where TB is common (e.g., Asia, Africa, and Latin America)
- the chest radiograph findings show evidence of previous TB

Interpreting Skin Test Results

HIV-infected inmates who fail to react to tuberculin may be anergic

Scientific basis for anergy testing is not well established

All HIV-infected persons (whether anergic or not) should get chest x-ray and further evaluation if indicated

Persons with a positive skin test reaction to tuberculin should be evaluated for INH preventive therapy after TB disease has been ruled out.⁴⁵

The absence of a reaction to the tuberculin test does not rule out the diagnosis of TB disease or infection. In immunosuppressed persons, delayed-type hypersensitivity responses such as tuberculin reactions may decrease or disappear. This condition, known as anergy, may be caused by many factors, such as

- HIV infection
- overwhelming miliary or pulmonary TB
- severe or febrile illness
- administration of corticosteroids or immunosuppressive drugs
- measles or other viral infections
- Hodgkin's disease
- sarcoidosis
- live-virus vaccination

On average, 10% to 25% of patients who have active TB disease have negative reactions when tested with a tuberculin skin test. Approximately one third of patients with HIV infection may have skin test reactions of less than 5 mm even though they are infected with *M. tuberculosis*.

HIV-infected inmates who are at high risk of being infected with *M. tuberculosis* may be evaluated for skin test anergy, if they fail to react to tuberculin. Anergy testing is done by administering at least two antigens other than tuberculin—such as tetanus toxoid, mumps, or *Candida*—by the Mantoux technique.⁴⁶ However, the scientific basis for anergy testing is not well established, and the skin test antigens currently in use for anergy testing are not standardized. For this reason,

all HIV-infected persons—whether anergic or not—should receive a chest radiograph and further diagnostic evaluation if indicated.

Medical and nonmedical staff should make every effort to safeguard the confidentiality of sensitive information while carrying out screening for TB infection or disease.

Follow-up Screening

Repeat skin test annually for long-term inmates and staff with negative PPD skin test results

Analyze skin test data periodically and investigate further if evidence suggests transmission

Evaluate symptoms annually for all infected persons who have not completed a course of therapy

Follow-up Screening

Long-term inmates and all staff members who have a negative skin test reaction should be skin tested annually (unless the facility is in a minimal risk area) to detect skin test conversions. Persons with a documented positive skin test result who have not completed a course of preventive therapy should be screened each year for symptoms

Analysis of Skin Test Data

Skin test conversion rate equals ratio of

- staff whose result converted to positive during interval (numerator)
- total previously PPD-negative staff tested during interval (denominator)

May also analyze skin test data of previously PPD-negative inmates

Cluster ≥ 2 skin test conversions with evidence suggesting transmission

of TB disease. However, annual chest radiographs are not necessary for the routine follow-up of infected persons. Tuberculin skin test results should be recorded in the individual's medical record (the hard copy) and as an individual record in an electronic database, if possible. An electronic database can be used to summarize tuberculin skin test results for the facility in aggregate form. Personal identifying information should be handled confidentially.

The database should be analyzed periodically to estimate the risk of acquiring new infection in the facility; however, this analysis should be done using the skin test results only of persons who have remained in the facility continuously from one skin test to the next. The tuberculin skin test conversion rate (CR) equals the number of staff whose tuberculin skin test result has converted from negative to positive during a specific interval (the numerator) divided by the total number of previously tuberculin-negative staff who are tested during the same interval (the denominator)

$$CR = \frac{\text{Conversions}}{\text{Population tested}}$$

Conversion rates can be calculated for previously tuberculin-negative inmates who are tested during the interval, provided that they have been in the facility since their previous skin test. In some facilities, it may be appropriate to analyze skin test data for specific areas or groups within the facility. (See case studies in appendix 1.) Further investigation and possibly more frequent testing is needed when a tuberculin skin test conversion rate is significantly higher than previous rates (see p. 50).

Diagnosis of TB Disease

All persons with a positive skin test reaction or symptoms suggestive of TB disease should be referred for a complete medical evaluation. This evaluation should include a medical history, a physical examination, a Mantoux tuberculin skin test, a chest radiograph, and any appropriate bacteriologic or histologic examinations. HIV testing is also recommended for persons in whom TB is suspected. As mentioned on p. 19, any staff member who has symptoms suggestive of TB should be sent home immediately and should not return to work until infectious TB disease has been ruled out by a qualified physician.

Medical History and Physical Examination

TB should be suspected in any person who has the symptoms listed on pp. 13-14. In addition, extrapulmonary TB should be considered in the differential diagnosis of ill persons who have general systemic symptoms of TB and who are at high risk for TB. (See p. 6.) Approximately 15% of TB cases are extrapulmonary. The symptoms of extrapulmonary TB depend on the site affected. TB of the spine may cause back pain; TB of the kidney may cause pus in the urine. Although extrapulmonary TB is rarely infectious, it is often accompanied by pulmonary TB. Persons in whom extrapulmonary TB is suspected should receive prompt medical attention.

Persons suspected of having TB should be asked about their history of exposure to TB and history of TB disease or infection. The state or local health department should be contacted for information about whether an inmate has ever been reported as a TB case or suspect, or has received TB treatment in the past. If a previous regimen was inadequate or if the patient did not adhere to therapy, TB may recur and may be drug resistant. Certain demographic factors (country of origin, age, ethnic or racial group) may increase the person's risk for exposure to TB. The following persons are more likely to have been exposed to or infected with *M. tuberculosis*

- close contacts of a person with infectious TB
- persons with a history of incarceration in a correctional facility
- persons who inject illicit drugs or other locally identified high-risk substance users (e.g., crack cocaine users)
- residents of institutional settings (e.g., homes for the mentally ill, homeless shelters)
- foreign-born persons from areas of the world where TB is common (e.g., Asia, Africa, and Latin America)
- medically underserved, low-income populations, including high-risk racial and ethnic groups (e.g., Asians and Pacific Islanders, blacks, Hispanics, and Native Americans)
- the elderly
- persons who may have occupational exposure to TB

In addition, it is important to determine whether the inmate has any medical conditions, especially HIV infection, that increase the risk for TB disease if infected. The risk may be approximately 3 times greater (as with diabetes) to more than 100 times greater (as with HIV infection) for persons who have these conditions than for those who do not. These conditions include

- HIV infection
- substance abuse (especially drug injection)
- recent infection with *M. tuberculosis* (within the past 2 years)
- chest radiograph findings suggestive of previous TB (in a person who received inadequate or no treatment)

Immunosuppression and TB Diagnosis

Diagnosis of TB is difficult in immunosuppressed persons, especially HIV-infected persons

Extrapulmonary TB is common with severe immunosuppression

Chest radiographs may not have a classical appearance in these persons

Encourage HIV testing and counseling for persons with TB disease or infection

- diabetes mellitus
- silicosis
- prolonged corticosteroid therapy
- other immunosuppressive therapy
- cancer of the head and neck
- hematologic and reticuloendothelial disease (e.g., leukemia and Hodgkin's disease)
- end-stage renal disease
- intestinal bypass or gastrectomy
- chronic malabsorption syndromes
- low body weight (10% or more below the ideal)

HIV counseling and testing should be offered to persons with TB disease or infection who have risk factors for HIV infection (e.g., history of multiple sexual partners, sexually transmitted disease [STD] history, drug use, unsafe tattooing), but who do not know their current HIV status. HIV counseling and testing should be carried out according to current guidelines and should include a personalized client-risk assessment.⁴⁷ In HIV-infected persons or other severely immunosuppressed persons, TB can be difficult to diagnose.³⁹ A striking clinical feature of TB in these patients is the high frequency of extrapulmonary involvement, usually with concomitant pulmonary TB. This extrapulmonary involvement appears to be more common in patients with severe HIV-induced immunosuppression.⁴⁸

A physical examination is an essential part of the evaluation of any person suspected of TB. While it cannot be used to confirm or rule out TB, it can provide valuable information about the person's overall condition and other factors that may affect how TB is treated.

Tuberculin Skin Testing

As discussed on p. 21, a negative reaction to the tuberculin skin test does not exclude the diagnosis of TB, especially for patients with active TB disease or HIV infection. In addition, some persons may have a false-negative reaction to the tuberculin skin test if they are tested too soon after being exposed to TB. All persons with a positive skin test reaction or symptoms suggestive of TB should be given a chest radiograph and a thorough medical evaluation.

Radiographic Examination

A posterior-anterior view of the chest is the standard radiograph needed for the detection and description of chest abnormalities. In some instances, other views (e.g., lateral, lordotic) or additional studies (e.g., CT scans) may be necessary. Abnormalities on a chest radiograph may be suggestive of, but are never diagnostic of, TB disease. However, chest radiographs may be used to rule out the possibility of pulmonary TB in a person who has a positive reaction to the tuberculin skin test and no symptoms of disease. For symptomatic persons, chest radiographs should be performed regardless of skin test results, and radiograph interpretations should be available within 24 hours.

In pulmonary TB, chest radiograph abnormalities often occur in the apical and posterior segments of the upper lobe or in the superior segments of the lower lobe. However, lesions may appear anywhere in the lungs and may differ in size, shape, density, and cavitation, especially in HIV-infected and other immunosuppressed persons. In severely immunosuppressed persons with pulmonary TB, the chest radiograph may not have a classical appearance, and almost any abnormality may indicate TB disease. For example, TB disease may cause infiltrates without cavities in any lung zone, or it may cause mediastinal or hilar lymphadenopathy. In rare cases, the radiograph of a severely immunosuppressed person with pulmonary TB disease may even appear entirely normal.⁴⁹

Specimen Collection

For suspected pulmonary or laryngeal TB, obtain 3 sputum specimens for smear examination and culture

For persons who cannot cough up sputum, use sputum induction

Follow infection control precautions during specimen collection

Diagnostic Bacteriology

Specimen collection. At least three sputum specimens should be examined, by AFB smear and culture, from all persons suspected of having pulmonary or laryngeal TB. Specimens should be collected in an appropriate TB isolation room or sputum collection booth, using proper precautions for protection from exposure. It is best to obtain a series of **three early morning specimens** collected on different days. Sputum should be routinely submitted for AFB smear and culture examinations from persons initially diagnosed with other respiratory diseases such as pneumonia if they fail to improve as expected after initiation of treatment.

For patients unable to cough up sputum, appropriately trained staff may use aerosol induction to stimulate the production of sputum. Again, it is important to collect specimens in a TB isolation room or sputum collection booth. Patients should be instructed

How to Collect a Sputum Specimen

Coach and directly supervise patients at least the first time sputum is collected. In addition, properly instruct them how to produce a good specimen. Inform all patients that sputum is the material brought up from the lungs and that mucus from the nose and throat and saliva are not good specimens. Instruct patients to follow these steps for producing a sputum specimen.

- Breathe deeply three times (you should have a tickling feeling at the end of a very deep breath).
- After the third breath, cough hard and try to bring up sputum from deep in your lungs.
- Expectorate the sputum into a sterile container, collecting at least one teaspoonful.
- Remain in the collection booth or TB isolation room until you are no longer coughing.

Coaching patients individually on how to expectorate can make sputum collection easier. Unsupervised patients can rarely provide an adequate specimen, especially the first time they try. Some patients may also need coaching on later collections.

to take several normal breaths of the aerosol mist, inhale deeply, cough hard, and then expectorate into the specimen container. It may take patients time—15 minutes is usually enough—to produce sputum. Because induced sputum is very watery and resembles saliva, it should be labeled “induced” to ensure that the laboratory staff do not discard it.

Smear Examination

Suspect TB in patient's with smears containing AFB

Use follow-up smear examinations to assess patient's infectiousness and response to therapy

Expect results within 24 hours of specimen collection

If the patient cannot cough up sputum and there is a reasonable suspicion of TB, bronchoscopy may be considered. Bronchial washings, brushings, or biopsy specimens can be obtained, depending on the diagnostic possibilities and findings. Sputum coughed up by the patient immediately after a bronchoscopy procedure may also be useful for a diagnosis.

During specimen collection, patients produce an aerosol that may be hazardous to health care workers or other patients in close proximity. For this reason, follow precautionary measures for infection control during sputum

collection, sputum induction, bronchoscopy, and other common diagnostic procedures. (See p. 34.)

Because TB can occur in almost any anatomical site, the appropriate clinical specimens other than sputum (e.g., urine, cerebrospinal fluid, pleural fluid, pus, or biopsy specimens) should be obtained for examination when extrapulmonary mycobacterial disease is suspected. If necessary, patients should be referred to a facility where such procedures can be performed.

Laboratory examination. Detection of AFB in stained smears examined microscopically may provide the first bacteriologic clue of TB disease; however, smear examination permits only the presumptive diagnosis of TB because the AFB on a smear may be mycobacteria other than *M. tuberculosis*. Furthermore, many TB patients have negative AFB smears. The results of the smear examination can be used to help determine the infectiousness of the patient. Patients who have positive smears are considered infectious because they can cough many tubercle bacilli into the air. Smear examination is a quick and easy procedure. Results should be available within 24 hours of the laboratory's receipt of a specimen.

A positive culture for *M. tuberculosis* confirms a diagnosis of TB disease. (TB may also be diagnosed on the basis of clinical signs and symptoms in the absence of a positive culture.) Submit all specimens for culture examination, regardless of AFB smear results. When modern laboratory methods are used, reliable culture results are usually available within 10 to 14 days of specimen collection. If a solid medium and conventional biochemical tests are used, the isolation of the organism can take 6 to 12 weeks.

For all patients, the initial *M. tuberculosis* isolate should be submitted for drug susceptibility testing. It is crucial to identify drug resistance as early as possible in order to ensure appropriate treatment. Drug susceptibility testing should be repeated for patients who do not respond adequately or who have positive culture results after 2 months of therapy. All susceptibility results should be promptly forwarded to the health department and to the physician caring for the patient. Again, the use of liquid culture media is faster than conventional methods and is the preferred method for determining susceptibility to first-line TB medications. If this method is used, results can be obtained within 5 days of inoculation.

Drug Susceptibility Testing

For all patients, test initial *M. tuberculosis* isolate for drug susceptibility

Repeat for patients who do not respond to therapy or who have positive cultures after 2 months of therapy

Forward susceptibility results promptly to health department

Follow-up bacteriologic examinations are important for assessing the patient's response to therapy. At a minimum, specimens should be obtained at monthly intervals until culture conversion to negative. Patients at an increased risk for drug resistance include

- persons who have a history of treatment with TB medications
- TB patients with a history of nonadherence
- contacts of persons known to have drug-resistant TB
- foreign-born persons from areas where the prevalence of resistant TB is high (e.g., Asia, Africa, and Latin America)

Case Reporting

Immediately report confirmed or suspected TB cases among inmates and staff to health department

Forward drug susceptibility results to health department

- residents of geographic areas in the United States where the prevalence of INH-resistant TB is documented to be 4% or greater
- persons whose smears or cultures remain positive after 2 months of therapy with TB medications

Further details about the collection and processing of specimens, smear examination and culture, and drug susceptibility testing can be found in "Diagnostic Standards and Classification of Tuberculosis."³⁹

Reporting Cases Identified Through Screening

Reporting of suspected or confirmed TB cases is required by law in every state. Correctional facilities should notify the state or local health department as soon as screening procedures detect a suspected TB case among inmates or staff. This is essential to provide access to health department resources for case management and contact investigation both within the facility and in the community. Such reporting is mandatory for all correctional facilities, whether public or private, federal, state, or local. For each suspected case of TB, the diagnosis or ruling out of TB should be entered immediately into

- the individual's medical record (the hard copy)
- an electronic TB database at the facility (if available)
- an electronic TB database at the headquarters office, if the system has multiple facilities

In addition, if an inmate is to be released from the facility before completing treatment or preventive therapy, the health department should be notified as far in advance as possible to ensure continued adherence and the timely completion of therapy.

All drug susceptibility results should be forwarded to the health department for use in

- developing an effective therapeutic regimen if drug resistance is present
- evaluating and treating infected contacts
- monitoring of rates of drug resistance in the area
- determining the best initial empirical regimen for the area

State and local health departments have different procedures for reporting TB and other infectious diseases. Correctional facilities should be familiar with the system used in their area.

CONTAINMENT

Infection Control

To effectively control TB, it is very important to detect, isolate and treat infectious cases as quickly as possible. Institutions should plan to do this by using several methods, including

- administrative measures that reduce the risk of exposure to persons who have infectious TB (e.g., symptom screening, TB isolation procedures, prompt treatment of persons who have TB disease)
- engineering control methods to prevent the spread and reduce the concentration of infectious droplet nuclei in the air (e.g., adequate ventilation systems, ultraviolet germicidal irradiation [UVGI], high-efficiency particulate air [HEPA] filtration)
- personal respiratory protective equipment in areas where there is an increased risk of exposure to *M. tuberculosis*, such as in TB isolation rooms

All correctional facilities must have guidelines for the prompt detection of persons who have symptoms suggestive of TB. These guidelines should include procedures for identifying TB suspects during initial screening, during follow-up screening, and during routine sick calls. Supervisory responsibility for TB control should be clearly assigned in these guidelines.

Containment

Promptly isolate persons suspected of having infectious TB

Treat TB patients and suspects with appropriate regimens, using DOT

Offer preventive therapy to PPD-positive persons when appropriate

Infectiousness

Infectiousness is directly related to the number of droplet nuclei containing tubercle bacilli that are expelled into the air. In general, persons who have or who are suspected of having pulmonary or laryngeal TB should be considered infectious if (1) they are coughing, they are undergoing cough-inducing or aerosol-generating procedures, or their sputum smears contain AFB; **and** (2) they are not receiving therapy, have just started therapy, or have a poor clinical or bacteriologic response to therapy.

Patients are considered noninfectious if they meet **all** the following criteria:

- they have received adequate therapy for 2 to 3 weeks
- they have a favorable clinical response to therapy
- they have three consecutive negative sputum smear results from sputum collected on different days

Patients with TB disease should be monitored closely for treatment failure or relapse. Smear examinations should be done regularly (e.g., every 1 to 2 weeks) until smears convert to negative. Persistent infectiousness is usually due to drug resistance or the patient's failure to take medications as prescribed. These possibilities should be considered for any patient who does not respond to therapy clinically within 2 to 3 weeks.

In patients with drug-resistant TB, infectiousness may last several weeks or even months. In these patients, the response to treatment should be monitored closely, and TB isolation maintained until infectiousness is ruled out. **Continued TB isolation should be considered for patients who have MDR TB** because these patients are more likely to experience treatment failure or relapse, which may prolong infectiousness.

TB Isolation Procedures

Persons who have suspected or confirmed pulmonary or laryngeal TB disease should be immediately placed in a TB isolation room that meets recommended standards.² It may be necessary to move a patient to another facility or a hospital where a TB isolation room is available. TB isolation rooms must have negative pressure relative to

other parts of the facility (air flow from the corridors into the room). The air flow of these rooms should be checked periodically to ensure proper air flow. "Lock-down" rooms or rooms used for solitary confinement are inadequate for TB isolation. Unless negative pressure and appropriate room exhaust are maintained by an appropriate ventilation system, *M. tuberculosis* can be transmitted into adjacent corridors and rooms.

TB isolation can be discontinued if the diagnosis of TB is ruled out. If a diagnosis of TB cannot be ruled out, the patient should remain in TB isolation until the patient has been

determined to be noninfectious. Current guidelines recommend that TB isolation rooms be monitored daily when in use to ensure that negative pressure is maintained.²

Isolation

Place persons with suspected or confirmed TB in respiratory isolation room immediately

Transfer patient immediately if adequate isolation room not available in facility

No special precautions are needed for handling the patient's dishes, books, laundry, bedding, or other personal items, because there is no evidence that *M. tuberculosis* can be transmitted by such contact.

The length of time required for a TB patient to become noninfectious after starting TB therapy varies considerably. TB isolation should be discontinued only when the patient is receiving effective therapy, is improving clinically, and has had three consecutive negative AFB smears from specimens collected on different days. In patients with drug-resistant TB, the response to treatment should be closely monitored, and TB isolation should be maintained until infectiousness is ruled out. Prolonged TB isolation should be considered for patients with MDR TB because these patients are more likely to experience treatment failure or relapse, which may prolong infectiousness.

Staff members with pulmonary or laryngeal TB pose a risk to inmates and other staff members while they are infectious, and they should be excluded from the workplace until they are noninfectious. After work duties are resumed and while the worker remains on anti-TB therapy, facility staff should receive periodic documentation from the worker's health care provider that the worker is being maintained on effective drug therapy for the recommended time period and that the sputum AFB smears continue to be negative.

Engineering controls are based primarily on the use of adequate ventilation systems. Ventilation systems are designed to reduce the concentration of infectious droplet nuclei in the air. They are used in TB isolation rooms to maintain negative pressure and to exhaust the air properly. Monitor TB isolation rooms daily when in use to ensure that negative pressure is maintained and that air is exhausted properly.

TB isolation room doors should be kept closed, except when patients or personnel must enter or exit the room, in order to maintain negative pressure. Ventilation systems can also be designed to minimize the spread of TB in other areas of facility, by promoting the circulation of fresh air and removing contaminated air from the facility.

Ventilation systems may be supplemented with **UVGI** in overcrowded, high-risk areas, such as holding units, reception and detention areas, and other communal areas. UVGI may kill *M. tuberculosis* contained in droplet nuclei. **HEPA filters** can also be used in ventilation systems to remove droplet nuclei from the air. When HEPA filtration or UVGI is used, proper installation and maintenance are essential to achieve

Isolation

Continue isolation until patient no longer infectious

Consider prolonging isolation for patients with MDR TB

Use supplemental measures in high-risk areas

- HEPA filters
- UVGI lights

effectiveness and to reduce potential health hazards (such as conjunctivitis due to UVGI overexposure).^{2,50}

Precautions to prevent the airborne transmission of tubercle bacilli are particularly important during and immediately after **procedures that stimulate coughing** (e.g., sputum collection, sputum induction, bronchoscopy, and aerosolized pentamidine treatments) by persons at risk for TB. Health care personnel should do the procedures in rooms or booths with negative air pressure in relation to adjacent rooms and hallways. The air from these rooms should be exhausted through a HEPA filter or directly to the outside and away from intake sources.

In some settings—for example, TB isolation rooms and rooms where cough-inducing procedures are done—administrative and engineering controls may not fully protect staff from infectious droplet nuclei. Medical or security staff involved in any of the following activities:

- performing or assisting with cough-inducing procedures
- carrying for infectious TB patients in isolation rooms
- transporting infectious TB patients in a closed vehicle

should be equipped with **personal respirators**. When respirators are used, a respiratory protection program including education and fit testing should be part of the correctional facility's TB control program.

Personal Respirators

Respirators should be worn by medical or security staff who

- perform or assist with cough-inducing procedures
- care for infectious TB patients in isolation rooms
- transport infectious TB patients in a closed vehicle

If inmates who may have infectious TB must be transported outside their isolation rooms for medically essential procedures that cannot be performed in the isolation room, they should be required to wear a **surgical mask** that covers their mouth and nose during transport. Such inmates should not under any circumstances be allowed to return to their housing area or any common activities area.

If urgent dental care must be provided to an inmate who has, or is strongly suspected of having, infectious TB, such care should be provided in a facility that has a TB isolation room. Dental workers should use respiratory

protection while performing procedures on such patients. Nonessential dental treatment should be deferred until a physician confirms that the inmate does not have infectious TB. If the inmate is diagnosed as having active TB, nonessential dental treatment should be deferred until the inmate is no longer infectious.⁵¹

Contact Investigation

Prompt and thorough contact investigation is essential for the control of TB. When a person with suspected or confirmed TB seems to be infectious, close contacts should be skin tested unless they have a documented history of a positive tuberculin skin test result.⁴ Close contacts are persons who sleep, live, or work with an infectious person or who share air with an infectious person through a common ventilation system. These persons are at the highest risk of acquiring infection.

If the skin testing of close contacts reveals that the rate of positive skin test results (the infection level) in this group exceeds that expected for a population of similar composition, the investigation should proceed to the next circle of contacts—those who have come in contact with the patient, but less frequently than the close contacts. Depending on the ventilation in a facility and the infectiousness of the index case, contacts may include any of the following:

- all cell mates
- all inmates and staff on a tier or unit
- all inmates and staff in a building (for patients who are very infectious)

This may include frequent visitors, inmates or staff who are no longer at the facility, or family or community members who were in close contact with the patient before incarceration. Health departments should help determine when a contact investigation should be extended to include more remote contacts.

The health department is responsible for identifying and testing contacts outside the correctional facility. For contacts within correctional facilities, a tracking system documenting transfers, releases, and movement within a facility or system can help identify and locate all exposed contacts. Information on inmate transfers and releases should be made available to other correctional facilities and to the health department when necessary.

Contacts with symptoms suggestive of TB should be promptly isolated and evaluated for active TB disease. In addition, contacts with a tuberculin reaction of 5 mm or greater should be considered infected and should receive a chest radiograph. Those without evidence of clinical disease should be evaluated for preventive therapy. Persons with an initial tuberculin reaction less than 5 mm should receive a chest radiograph and be considered for preventive therapy if

Contact Investigation

Use inmate tracking system to help identify contacts (all persons potentially exposed to an infectious patient)

Begin skin testing with close contacts

Expand investigation to other contacts if evidence of transmission

- the contact is a child or adolescent or is immunosuppressed (especially due to HIV infection)
- circumstances suggest a high probability of infection
- evaluation of other contacts with a similar degree of exposure suggests recent transmission

Contacts who have a negative reaction to an initial skin test should be retested 10 weeks after they were last exposed to TB. If the reaction to the second skin test is

negative and contact with the source case has been broken, preventive therapy may be stopped. If the second skin test reaction is positive, preventive therapy should be initiated or continued, unless contraindicated. Contacts who are HIV infected should be considered for preventive therapy, regardless of their tuberculin skin test results.⁴

Contact Investigation

Evaluate for preventive therapy if

- contact is PPD positive (≥ 5 mm induration)
 - contact is PPD negative but
 - ✓ transmission likely
- or**
- ✓ contact is child or is HIV infected

Retest PPD-negative contacts 10 weeks after exposure ended

A patient with clinically active TB disease may have negative sputum smears, especially if recently infected. Although such persons are not likely to be infectious, their close contacts should also be examined in some circumstances (1) to find a source case and (2) to

identify newly infected inmates or staff. High priority should be given to evaluating contacts who are children or who have HIV infection.

While carrying out a contact investigation, staff should make every effort to ensure the confidentiality of sensitive information. (See the case studies in appendix 1 for an example of a contact investigation.)

Treatment

TB must be treated for a long time (6-24 months) compared with many other infectious diseases. If treatment is not continued for a sufficient length of time, some tubercle bacilli may survive, and the patient may become ill and infectious again. Regimens for the treatment of TB must contain multiple drugs to which the organisms are susceptible. The administration of a single drug can lead to the development of a bacterial population resistant to that drug. Likewise, the addition of a single drug to a failing regimen often leads to resistance to that drug. When two or more drugs are used simultaneously, each helps prevent the emergence of tubercle bacilli resistant to the others.

For each new case of TB in an inmate, a specific treatment and monitoring plan should be developed in collaboration with the local health department within 1 week of the presumptive diagnosis. This plan should include a description of the treatment regimen, the methods of assessing and ensuring adherence, and the methods of monitoring for adverse reactions.

The basic principles of TB treatment in adolescents are essentially the same as for adults; however, special considerations are necessary for children 12 years of age or younger.

Further details about the treatment of TB disease and infection can be found in the “Treatment of Tuberculosis and Tuberculosis Infection in Adults and Children.”²³

Treatment Basic Principles

Provide safest, most effective therapy in shortest time

Use multiple drugs to which organisms are susceptible

Never add only a single drug to a failing regimen

Ensure adherence to therapy

Adherence

Nonadherence is a major problem in TB control. Inadequate or interrupted treatment for TB can lead to relapse, continued transmission, and the development of drug resistance. After effective therapy has been started, it is critical that patients continue treatment without interruption until they complete an entire course of therapy. If treatment lapses for any reason, prompt action should be taken to ensure that therapy is reinstated.

All inmates being treated for TB disease should be given DOT, in which a medical worker, a specially trained correctional officer, or a health department employee watches the inmate swallow each dose of medication. DOT is the best way to ensure that patients adhere to therapy. Furthermore, DOT can significantly reduce the frequency of acquired drug resistance and relapse. Close monitoring can also enable staff to promptly identify any adverse reactions requiring a reevaluation of the patient’s treatment plan. Medication should **not** be given to an inmate without direct observation of drug ingestion.

When DOT is used, TB medication may be given twice weekly (with an appropriate change in dosage) after an initial period of

DOT

Nonadherence is a major problem!

Watch patient swallow each dose of medication (DOT)

Use DOT for all inmates to prevent relapse and acquired drug resistance

Ensure follow-up after transfer or release so that patients complete therapy

daily medication or may be given three times weekly from the beginning of therapy. Using intermittent regimens reduces the total number of doses a patient must take, as well as the total number of encounters with the health care provider. (See below and appendix 3 for specific regimens.)

Before release or transfer of an inmate on DOT, provisions should be made for the health department or receiving facility to oversee continued adherence and to ensure the timely completion of therapy. The correctional facility should provide appropriate medical records to the health department or receiving facility. In certain instances, DOT has been made a condition of parole for inmates released before completion of therapy for TB disease.

Pulmonary TB (see appendix 3)

Current ATS-CDC recommendations should be followed for the treatment and management of adults and adolescents with suspected or confirmed TB disease. For patients with smear- or culture-positive pulmonary TB, the initial phase of a 6-month regimen should consist of a 2-month period of INH, rifampin (RIF), and pyrazinamide (PZA). Ethambutol (EMB) or streptomycin (SM) should be included in the initial regimen until the results of drug susceptibility studies are available.

**Treatment
Initial Regimen**

Include four drugs

- INH
- RIF
- PZA
- EMB or SM

Three drugs (INH, RIF, PZA) adequate if drug resistance very unlikely

The initial use of a four-drug regimen is recommended to prevent the development of MDR TB in areas where primary INH resistance is increased. An initial three-drug regimen (INH, RIF, and PZA) is only considered adequate if there is little possibility of drug resistance (i.e., the primary INH resistance rate in the community is less than 4% and the patient has had no previous treatment for TB, is not from a country with a

high prevalence of drug-resistant TB, and has had no known exposure to a patient with drug-resistant TB).²³ If susceptibility to INH and RIF is demonstrated, the second phase of treatment should consist of INH and RIF for 4 months.

When DOT is used, medications may be dosed intermittently. Several options exist for 6-month, intermittent regimens.

1. Four-drug therapy can be administered daily for 8 weeks, then followed by therapy with INH and RIF given two or three times a week for 16 weeks (if susceptibility to INH and RIF is demonstrated).

2. Four-drug therapy can be administered daily for 2 weeks, then two times a week for 6 weeks. Subsequently, therapy with INH and RIF may be given two times a week for 16 weeks (if susceptibility to INH and RIF is demonstrated).
3. Four-drug therapy may be administered three times a week throughout the 6-month treatment period. All four drugs should be continued throughout the course of treatment in this regimen.

When INH, EMB, PZA, or SM are given two or three times a week instead of every day, the dose must be increased. However, the dose of RIF is the same whether the drug is given daily or intermittently.²³

Alternatively, a 9-month regimen of INH and RIF is acceptable for persons who cannot or should not take PZA. Again, include EMB or SM initially unless there is little possibility of drug resistance (see preceding). If susceptibility to INH and RIF is demonstrated, INH and RIF may be given twice weekly after an initial 1 or 2 months of daily treatment.

For patients with smear- and culture-negative TB, a 4-month regimen of INH and RIF, preferably combined with PZA for the first 2 months, may be used when drug resistance is unlikely. However, for patients with smear- and culture-negative pulmonary TB who have individual risk factors for drug resistance or who live in an area where the prevalence of INH-resistant TB is 4% or greater, four drugs (INH, RIF, PZA, and EMB or SM) should be continued throughout the 4-month regimen.

The recommendations for duration of TB treatment in HIV-infected persons are the same as for persons not infected with HIV. However, the presence of HIV infection necessitates close monitoring for adverse reactions to drugs, treatment failure, and relapse. Inmates with TB disease should be strongly encouraged to undergo appropriate counseling and testing for HIV infection. Treatment for TB in HIV-infected persons should be prolonged if the response is slow or otherwise suboptimal.²³

Extrapulmonary TB (see appendix 3)

As a general rule, regimens that are adequate for treating pulmonary TB in adults and children are also effective for treating extrapulmonary disease. Using adjunctive therapies such as surgery and corticosteroids is more commonly required for extrapulmonary TB than for pulmonary disease. For patients with extrapulmonary TB, the type of follow-up examinations should be determined by the site of disease. Bacteriologic evaluation may be limited by the relative inaccessibility of the site. Thus, the response to treatment must often be judged on the basis of clinical and radiographic findings. Clinicians who are unfamiliar with the treatment of extrapulmonary TB should seek expert consultation.

Pregnant or Lactating Women

Because PZA and SM should be avoided in pregnant women, it is important to rule out pregnancy in women of childbearing age before initiating treatment for TB disease. Pregnant women with TB should be given adequate therapy as soon as TB is suspected. The preferred initial treatment regimen is INH, RIF, and EMB (EMB may be excluded if primary INH resistance is unlikely). SM should not be used because it has been shown to have harmful effects on the fetus. In addition, PZA should not be used routinely because its effect on the fetus is unknown. Because the 6-month treatment regimen cannot be used, a minimum of 9 months of therapy should be given. To prevent peripheral neuropathy, pyridoxine should be given to pregnant women who are taking INH.

Drug-resistant TB

A 6-month regimen of INH, RIF, PZA, and either EMB or SM has been demonstrated to be effective for the treatment of TB resistant only to INH. When resistance to INH is documented during the recommended initial four-drug therapy, an alternative is to discontinue INH and continue the other three drugs for the entire 6 months of therapy. TB resistant only to INH may also be treated with RIF and EMB for 12 months.

MDR TB (i.e., TB resistant to at least INH and RIF) presents difficult treatment problems. Adequate data are not available on the effectiveness of various regimens and the necessary duration of treatment for patients with organisms resistant to both INH and RIF. Moreover, many of these patients also have resistance to other first-line drugs (e.g., EMB and SM) when drug resistance is discovered.

Treatment of MDR TB must be individualized and must be based on the patient's medication history and susceptibility studies. Because of the poor outcome in such cases, it is preferable to give at least three new drugs to which the organism is susceptible. This regimen should be continued at least until bacteriologic sputum conversion is documented, followed by at least 12 months of two-drug therapy. Often a total of 24 months of therapy is given empirically. Because second-line drugs can cause serious adverse reactions, patients taking these drugs should be monitored closely throughout the course of treatment. Clinicians who are unfamiliar with the treatment of drug-resistant TB should seek expert consultation.

Monitoring

Medical units should schedule regular monitoring appointments for inmates on DOT. Clinicians who treat TB should be familiar with the methods of monitoring for adverse reactions and response to treatment.

Adverse Reactions. All patients should be monitored by trained personnel for signs and symptoms of adverse reactions during therapy. If signs or symptoms of an adverse reaction appear or if drug intolerance develops, a thorough medical evaluation is necessary. In some situations, it may be necessary to adjust the regimen so that the patient can complete therapy. Expert medical consultation should be sought for the monitoring and treatment of patients with complex problems or associated medical problems (e.g., AIDS, diabetes, alcoholism, pregnancy, extrapulmonary or drug-resistant TB).

Adverse reactions to TB drugs are relatively rare, but in some patients they may be severe. To detect any abnormality that would complicate therapy or require a modified regimen, baseline measurements of hepatic enzymes, bilirubin, and serum creatinine or blood urea nitrogen, as well as a complete blood and platelet count (or estimate) should be obtained for all adults treated for TB. Serum uric acid should be measured if PZA is used, and a baseline examination of visual acuity obtained for patients for whom EMB is prescribed. Audiometry should be performed at the beginning of therapy for patients for whom SM is prescribed.

Treatment Follow-up

Monitor patients at least monthly for adverse reactions and response to therapy

Adjust regimen according to drug susceptibility results

If susceptibility to INH and RIF demonstrated, continue INH and RIF for 4 months

All patients receiving INH, RIF, or PZA should be instructed to report immediately any symptoms suggesting hepatitis (nausea, loss of appetite, vomiting, persistently dark urine, yellowish skin, malaise, unexplained elevated temperature for more than 3 days, or abdominal tenderness). Patients receiving RIF twice weekly should be monitored for possible manifestations of thrombocytopenia (bleeding tendency, easy bruising, blood in urine) or flulike syndromes.

Peripheral neuropathy is associated with the use of INH but is uncommon at doses of 5 mg/kg. Pyridoxine (10-50 mg/day) should be administered with INH to persons who have conditions in which neuropathy is common (e.g., diabetes, uremia, alcoholism, malnutrition), as well as to pregnant women or persons who have a seizure disorder. As little as 6 mg/day of pyridoxine has been shown to prevent INH-associated neuropathy.

RIF may accelerate the clearance of drugs metabolized by the liver. These include methadone, coumadin derivatives, glucocorticoids, estrogens, oral hypoglycemic agents, digitalis, anticonvulsants, ketoconazole, fluconazole, and cyclosporin. For patients who are in a drug treatment program, it may be necessary to increase the

methadone dose by as much as 50%. RIF may also reduce the efficacy of oral contraceptives and contraceptive implants (e.g., Norplant) by accelerating estrogen metabolism. Women taking RIF should use an alternative or supplementary birth control method. Current literature and package inserts should also be consulted for other possible drug reactions. (See appendix 3 for more information on common adverse reactions to TB drugs.)

Response to Treatment. In persons who have positive smears or cultures at the beginning of therapy, response to treatment should be monitored by smear and culture examination at least monthly until the results are negative. Treatment failure is usually due to patient nonadherence to therapy but may be due to the presence of drug resistance. Drug susceptibility testing should be performed on all initial *M. tuberculosis* isolates, regardless of smear results. If cultures continue to be positive after 2 months of recommended therapy or if the patient shows signs of relapse, drug susceptibility tests should be performed again and adherence to the prescribed regimen should be reassessed. While results of drug susceptibility testing are pending, the original drug regimen may be continued or may be augmented by at least three drugs not given previously.

Clinicians should never add one drug at a time to a failing regimen. This may cause further drug resistance. If drug susceptibility results show resistance to any of the first-line drugs or if the patient remains symptomatic or smear or culture positive after 3 months, a TB medical expert should be consulted. Patients with MDR TB should have smears and cultures performed monthly for the entire course of treatment.

In patients with negative sputum cultures before treatment, the major indicators of response to therapy are the chest radiograph and the clinical evaluation. The intervals at which chest radiography should be repeated depend on the clinical circumstances and the differential diagnosis that is being considered. If the radiograph does not improve after the patient has received 3 months of treatment, the abnormality may be the result of either previous (not current) TB or another process.

Patients whose sputum no longer contains *M. tuberculosis* after 2 months of treatment should have at least one further sputum smear and culture performed at the completion of therapy. Radiographic evaluations during treatment are of less importance than sputum evaluation. However, a chest film at completion of treatment provides a baseline for comparison with any future films.

Routine follow-up after therapy is not necessary for patients who have had a satisfactory and prompt bacteriologic response to 6- or 9-month therapy with INH and RIF. Patients whose organisms were fully susceptible to the drugs being used should be instructed to report promptly the development of any symptoms, particularly prolonged cough, fever, or weight loss. For patients with organisms resistant to INH or RIF, or both, follow-up evaluation must be individualized.

Preventive Therapy

Priority Candidates

Persons in the following high-risk groups should be given high priority for preventive therapy if they have a positive skin test result, **regardless of their age** (the criterion for a positive reaction, in millimeters of induration, is given in parentheses):

- Persons known to have HIV infection (5 mm or greater)
- Persons at risk for HIV infection (including persons who inject drugs) but whose HIV status is unknown (5 mm or greater)
- Close contacts of a person with infectious TB (5 mm or greater)
- Persons who have chest radiograph findings suggestive of previous TB and who have received inadequate or no treatment (5 mm or greater)
- Persons who inject drugs and who are known to be HIV negative (10 mm or greater)
- Persons who have medical conditions known to increase the risk for TB disease (10 mm or greater) (See p. #.)
- Persons whose tuberculin skin test reaction converted from negative to positive within the past 2 years (10 mm or greater increase if younger than 35 years of age; 15 mm or greater increase if 35 years of age or older)

High-priority persons should start a course of preventive therapy unless it is medically contraindicated, and should be monitored closely to ensure that they complete a full course.

In the absence of any of the preceding risk factors, inmates younger than 35 years of age should be evaluated for preventive therapy if their reaction to the tuberculin skin test is 10 mm or greater.^{1,23} These persons are lower in priority and should start preventive therapy only if they are likely to complete at least 6 months of preventive therapy (i.e., the correctional facility has formal agreements with collaborating facilities and the local health department for referral and follow-up upon transfer or release of the inmate). Staff who are not in the high-risk groups listed above but are younger than 35 years of age should also be evaluated for preventive therapy if their skin test reaction is 10 mm or greater.

Preventive Therapy

Evaluate PPD-positive, high-risk persons for preventive therapy regardless of age

Evaluate other PPD-positive persons for preventive therapy if they are younger than 35 years of age

Rule out TB disease before administering preventive therapy

Preventive Therapy

Give at least 6 months of DOPT

Encourage HIV counseling and testing; give 12 months of DOPT to HIV-infected persons

Monitor patients for adverse reactions

Ensure follow-up of high-risk persons after transfer or release

Persons infected with HIV and *M. tuberculosis* are at very high risk for the development of TB disease and should have the highest priority for preventive therapy, regardless of their age. For this reason, HIV counseling and testing should be offered to all inmates known to have a positive tuberculin skin test result. Persons who are known to have HIV infection or who are at risk for HIV infection but whose HIV status is unknown should be encouraged to complete 12 months of preventive therapy if they have a positive skin test result.

In general, preventive therapy should not be given to pregnant women who are found to be tuberculin positive upon routine screening until after delivery. However, INH preventive therapy should be given to pregnant women who are likely to have been recently infected or who have high-risk medical conditions, especially HIV infection, as soon as TB infection is documented and TB disease has been ruled out. Tuberculin skin testing is safe and reliable throughout the course of pregnancy.

Preventive therapy may not be an option for all inmates and staff members who have positive skin test results. Inmates who will be released before at least 1 month of therapy can be given are highly unlikely to complete the minimum 6-month course of preventive therapy. Preventive therapy is not recommended for such persons unless they are at very high risk for the development of TB disease (e.g., HIV-infected persons or close contacts). Other persons for whom preventive therapy with INH might not be indicated include

- persons at high risk for adverse reactions to INH (e.g., persons 35 years of age or older who are not in high-risk groups and persons for whom INH is contraindicated)
- persons who cannot tolerate INH
- persons likely to be infected with drug-resistant *M. tuberculosis*

Persons for whom TB preventive therapy is recommended but who refuse or are unable to complete a recommended course of therapy should be counseled to seek prompt medical attention if signs or symptoms suggestive of TB develop. Routine periodic chest radiographs of persons with a documented positive skin test reaction generally are not useful for detecting disease in the absence of symptoms. Chest radiographs should be taken only if symptoms, especially a persistent cough, develop.

Standard Regimens

Clinical trials have shown that daily INH preventive therapy for 12 months reduces the risk for TB disease by more than 90% in infected patients who complete a full course of therapy. There is evidence that 6 months of preventive therapy with INH also confers a high degree of protection (approximately 69% in patients who complete the regimen) against the progression of TB infection to TB disease. Every effort should be made to ensure that patients adhere to preventive therapy for at least 6 months. Persons known to have HIV infection or at risk for HIV infection but whose HIV status is unknown should receive 12 months of INH preventive therapy.

All inmates receiving preventive therapy should be given directly observed preventive therapy (DOPT), in which a medical worker, a specially trained correctional officer, or a health department employee watches the inmate swallow each dose of medication. Because daily supervised therapy often is not feasible, twice-weekly supervised therapy is suggested as a satisfactory alternative when DOPT is used. Most experts believe that twice-weekly intermittent preventive therapy (using INH at a dose of 15 mg/kg, with a maximum dose of 900 mg) is safe and effective, although it has not been studied in controlled clinical trials.²³ Medication should **not** be given to an inmate without direct observation of drug ingestion. Provisions should be made before release or transfer for the health department or receiving facility to oversee completion of an appropriate course of preventive therapy.

Alternative Regimens

For patients who have a positive tuberculin skin test result and either silicosis or a chest radiograph demonstrating old fibrotic lesions and who have no evidence of TB disease, acceptable regimens include either 4 months of INH plus RIF or 12 months of INH, provided that infection with drug-resistant organisms is judged to be unlikely.

For close contacts of infectious TB patients who have INH-resistant TB, preventive therapy with RIF should be considered. Therapy should be administered at the usual therapeutic dose for at least 6 months. In addition, a RIF-based preventive therapy regimen should be considered for INH-intolerant patients.

For persons likely to have been infected with *M. tuberculosis* resistant to both INH and RIF, observation without preventive therapy is usually recommended because no other drugs have been evaluated for preventive therapy. However, for persons at an especially high risk for TB disease once infected (e.g., persons with HIV infection), preventive therapy with an alternative regimen should be strongly considered. Clinicians who are unfamiliar with alternative preventive therapy regimens should seek expert consultation.

Monitoring

Before preventive therapy is started, it is important to

- rule out the possibility of TB disease (with a medical history and chest radiograph)
- ask about a history of treatment for TB infection or disease
- check for contraindications, including previous INH-associated hepatic injury; history of severe adverse reactions to INH, such as a drug fever, rash, or arthritis; and acute or unstable liver disease of any cause
- determine whether the patient is at high risk for adverse reactions

At least once a month throughout the entire period of therapy, medical units should schedule appointments for inmates receiving DOPT, including careful monitoring for

- adherence to the prescribed regimen
- symptoms of hepatitis, such as nausea, loss of appetite, vomiting, persistently dark urine, yellowish skin, malaise, unexplained elevated temperature for more than 3 days, or abdominal tenderness (especially right upper quadrant)
- signs of hepatitis detected during the physical examination
- symptoms of neurotoxicity due to INH, such as paresthesias of the hands or feet
- signs and symptoms of TB disease

Medical personnel who are providing DOPT should be familiar with the signs and symptoms of adverse reactions to medications, and should question patients regularly. Any symptoms suggesting an adverse reaction should be reported immediately to the clinician managing the case.

Peripheral neuropathy is associated with the use of INH but is uncommon at doses of 5 mg/kg. Pyridoxine (10-50 mg/day) should be administered with INH to persons with conditions in which neuropathy is common (e.g., diabetes, uremia, alcoholism, malnutrition), as well as pregnant women or persons with a seizure disorder. As little as 6 mg/day of pyridoxine has been shown to prevent INH-associated neuropathy.

Because of a high risk for adverse reactions, special precautions are recommended for persons who

- are 35 years of age or older
- are currently using another medication that may cause drug interactions
- may abuse alcohol (associated with a higher incidence of INH-associated hepatitis)
- have a history of discontinuing INH because of adverse effects (e.g., headaches, dizziness, nausea)
- have chronic liver disease
- have peripheral neuropathy or a condition that may predispose to the development of neuropathy (e.g., diabetes mellitus or alcoholism)

- are pregnant
- inject drugs

Some evidence suggests that women, particularly black and Hispanic women, are at increased risk for fatal hepatitis associated with INH. This risk may also be increased during the postpartum period. Special precautions should be taken for all persons at high risk for adverse reactions, including a measurement of hepatic enzymes prior to therapy and monthly throughout treatment, and monthly symptom reviews.²³

Approximately 10% to 20% of persons taking INH will have some mild, asymptomatic elevation of liver enzymes. These abnormalities tend to resolve even if INH is continued. If any of the measurements exceeds three to five times the upper limit of normal or the patient reports symptoms of adverse reactions, strongly consider discontinuing INH.

Patients should be educated about the symptoms of hepatitis and other adverse reactions to preventive therapy medications, and advised to report immediately to the medical staff if any of these symptoms occur during preventive therapy. In addition, all patients who start preventive therapy should be advised to report immediately any symptoms of TB disease.

Before release or transfer of an inmate on preventive therapy, provisions should be made for the health department or receiving facility to oversee completion of an appropriate course of therapy. Some jurisdictions have succeeded in making completion of DOPT a condition of parole for high-risk persons infected with M. tuberculosis who are released before completing therapy.

ASSESSMENT

General Guidelines

Record systems are essential for tracking all inmates and staff members and for assessing the status of persons who have TB disease or TB infection within the correctional facility. Inmates in large jails and prison systems are transferred frequently from place to place and from unit to unit. Thus, it is essential to maintain an organized information system for tracking all inmates and for assessing the status of persons who have TB disease and infection in prisons and jails. The information system should be structured to maintain current records of the location, screening results, treatment status, and degree of infectiousness of these persons. Optimally, this information system should include both hard copies of individual records and an electronic database that can be used to summarize records in an aggregate form. (For sample record and aggregate report forms, see appendix 4. These forms are based on the CDC's new *Tuberculosis Information Management System [TIMS]* discussed below.)

Assessment

- Maintain up-to-date, organized records for risk assessment and program review
- Evaluate skin test data for evidence of transmission
- Assess completion of therapy and preventive therapy
- Evaluate success of referrals to health departments and other CFs

The record system also should provide data needed to assess the overall effectiveness of TB control efforts. The following aggregate information should be reviewed at least annually for all inmates and staff present during the specified time period:

- the number of staff and inmates currently infected with *M. tuberculosis*
- the number of persons newly infected (persons who have skin test conversions)
- the number of persons who start preventive therapy
- the percentage of persons who complete the prescribed preventive therapy regimen (goal is 95% or greater), excluding those who are released or transferred out of the facility
- the number of diagnosed TB cases and the case rate
- the percentage of persons diagnosed with TB who complete the prescribed treatment regimen (goal is 95% or greater), excluding those who are released or transferred out of the facility
- the number of infectious (i.e., smear-positive) patients
- the percentage of inmates released or transferred out of the system who keep their scheduled referral appointment (goal is 90% or greater)

Role of CF

Carry out TB control activities in facility according to current guidelines

Develop formal agreements with health department for help with

- contact investigations
- follow-up of inmates released before completing therapy

Collaborate and consult with health department for training and education

It may be necessary to request that health departments and receiving facilities provide formal notification of the successful receipt of referrals for inmates on DOT who are released or transferred into the jurisdiction. This is a very important component of a good TB control program, since persons who are lost to follow-up are at high risk of never completing therapy and for the development of drug-resistant TB disease. Inmates on DOPT who are released or transferred to other correctional facilities should also be referred for follow-up treatment; however, assessing the

percentage of inmates on DOPT who keep their scheduled referral appointment is a lower priority than it is for inmates on DOT.

In multifacility systems, these data should be compiled for individual facilities and for the system as a whole, with results provided to corrections and health department officials. Inmates transferred within a system should be included in this analysis. In large facilities, it may be necessary to analyze the data by unit. (See appendix 1 for case studies.)

Some facilities, especially larger facilities serving a great number of inmates, should consider an electronic TB information system. The CDC's *TIMS* is new Windows® application that is being developed and will soon be used by most state health departments. In certain areas, *TIMS* may be used at selected sites within health department jurisdictions, including some correctional facilities. Whatever system is used, an electronic database can be used to

- find information on TB cases or suspects previously reported from the facility
- manage information on a patient's medical history, tuberculin skin test results, and chest radiograph results
- manage information on persons receiving DOT or DOPT
- manage information on contacts to an infectious TB case

In some instances, the database can be used to report cases directly to the state or local health department. *TIMS* is one example of an electronic system with this capacity.

Evaluation of Possible Transmission Problems

Several situations may indicate a need for further epidemiologic investigation. These include, but are not limited to

- the occurrences of skin test conversions or TB disease in staff members

- situations in which inmates or staff members with TB disease are not promptly identified and isolated, thus exposing other persons in the facility to *M. tuberculosis*

The general objectives of this investigation are as follows:

- to determine the likelihood that transmission of and infection with *M. tuberculosis* has occurred in the facility
- to determine the extent to which *M. tuberculosis* has been transmitted
- to identify those persons who have been exposed and infected, enabling them to receive appropriate clinical management and treatment
- to identify factors that could have contributed to transmission and to implement appropriate interventions
- to evaluate the effectiveness of any interventions that are implemented and to ensure that exposure to and transmission of *M. tuberculosis* have been terminated

The exact circumstances of these situations are likely to vary considerably, and the associated epidemiologic investigations should be tailored to the individual circumstances. For a more detailed example of conducting a problem evaluation, please refer to section II-K of the CDC’s “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994.”²

Role of the Correctional Facility

The correctional facility should be responsible for in-facility TB screening, containment, and assessment unless otherwise mandated by legal statute. In all correctional facilities, officials should work closely with the state and local health departments in the jurisdiction. Correctional facilities, including local jails, are advised to have formal written working agreements with the health department in their area. These written agreements should delineate responsibilities and specify procedures for the following activities:

- screening and treatment of inmates
- follow-up of symptomatic inmates
- follow-up of inmates who have abnormal chest radiographs
- contact investigation within the facility for reported TB cases
- follow-up of inmates released before completing treatment for TB disease
- follow-up of inmates released before completing preventive therapy

Role of Health Department

Designate a specific person to work with CFs

Assist CFs in developing, implementing, and updating

- TB control policies and procedures
- training and educational programs
- tracking and patient record systems
- HIV prevention programs

Correctional facilities should also collaborate with health department staff to provide education and counseling about TB to inmates and staff.

Role of the Health Department

Health departments should assist correctional facilities in developing and updating policies, procedures, and record systems for TB control. The health department should also provide access to expert TB medical consultation and ensure that correctional

facilities have access to adequate laboratory services. A specific health department contact person should be designated to provide epidemiologic and management assistance to correctional facilities. This responsibility may initially require considerable onsite consultation at the correctional facility. Small jails may need more direct support from the health department. For instance, it may be possible for health department staff to perform screening activities or administer DOT.

Health department staff should help develop programs to train correctional facility staff to

- perform, read, and record tuberculin skin tests
- identify signs and symptoms of TB disease
- initiate and observe therapy
- monitor medication side effects
- collect diagnostic specimens
- educate inmates
- maintain record systems

Health or corrections departments may wish to certify correctional staff who complete the health department training. In addition, health department officials should provide related educational information about TB for senior-level prison and jail authorities, county boards of supervisors, and other appropriate elected officials.

Health departments should also provide consultation for contact investigations for each case within correctional facilities and ensure appropriate examinations for community contacts of the persons found to have TB in these facilities. In addition, health departments should cooperate with correctional staff in arranging continued treatment for inmates released while receiving TB treatment or preventive therapy and in identifying TB among persons who enter the facility.

Role of Health Department

- Ensure that released inmates complete therapy
- Assist with contact investigations in CFs
- Analyze TB morbidity in CFs
- Provide or refer to expert clinical consultation
- Ensure access to adequate laboratory services

Health departments have a responsibility to maintain TB registries with updated medical information on all current TB patients in their jurisdictions, including persons in correctional facilities. Cross-matching information from the TB registry with the names of inmates admitted into correctional facilities can help identify persons with TB disease who fail to report their TB history or locate patients who have been lost to follow-up (New York City Department of Health, unpublished data). TB case records should be assessed quarterly, and necessary revisions in policies or procedures should be recommended. In addition, health departments should regularly collect information on TB cases reported in correctional facility inmates and staff and should periodically assess the impact of TB infection and disease in correctional facilities on the community as a whole.

Because inmates may have both TB and HIV infection, health department officials should assist correctional facilities in developing and implementing HIV prevention programs. Such programs should include strategies to identify persons practicing high-risk behaviors, to reduce high-risk behaviors among all inmates, and to counsel HIV-infected persons.

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Appendices

- 1. Case Studies**
- 2. Screening Algorithms**
- 3. Treatment Tables**
- 4. Informan Systems**
- 5. NCCHC Contact Information**

1. Case Studies

Case Study #1

The Hard Rock Correctional Facility is a medium-security prison housing male inmates in a rural area of the South. It currently has an inmate population of 1,589 and a design-rated capacity of 1,500. The housing of the main prison unit is composed of seven wings, located off a main administrative corridor. Hard Rock's infirmary, which is located in the administrative corridor, has no respiratory isolation rooms. Each wing contains 100 two-person cells arranged on two tiers; in addition, there are 80 single-occupancy cells for maximum security and administrative segregation. Two satellite facilities containing 50 beds each are used to house inmates on work release to neighboring farms.

On May 5, 1995, John Walker entered Hard Rock for the second time. (He had previously served a 2-year sentence.) Walker had a negative reaction to the tuberculin skin test. He reported a persistent cough, but ascribed it to his heavy smoking. No further medical evaluation was done, and Walker was placed in a two-person cell on the upper tier of Wing D.

On June 9, Walker complained that he had been coughing up blood and had chest pains and difficulty sleeping. He was referred to the medical unit, where a chest x-ray was performed (showing an infiltrate in the left upper lobe) and a sputum specimen was collected. He was transferred to the infirmary.

On June 16, a report of a positive AFB smear was mailed in from the facility's contracting laboratory. While reviewing Walker's medical file from his previous incarceration (in 1987), staff found that Walker had had a positive skin test result (17 mm) on entry and had weighed at least 40 pounds more than his current weight.

Medical staff called the county health department for help referring Walker to a facility with a TB isolation unit. They discovered that Walker had been reported to the health department as a TB suspect in March, when he was admitted to a neighboring city hospital. Walker had started TB medications but left the hospital against medical advice and subsequently could not be located. The hospital lab reported a culture positive for *M. tuberculosis* on a specimen submitted on March 25.

Questions:

- 1) What problems contributed to delays in identifying and isolating this potentially infectious case of TB? How could these problems have been avoided?

2) What steps does Hard Rock need to take in carrying out a contact investigation?

3) Skin-testing of contacts revealed the following:

- 16 of 43 inmates on the upper tier of Wing D had positive skin-test results (37%)
- 6 of 12 staff working on the upper tier of Wing D had positive skin-test results (50%)
- 2 of 3 inmates housed in the infirmary had positive skin-test results (67%)
- 3 of 7 staff working in the infirmary had positive skin-test results (43%)

How should these data be interpreted? What should the next step be?

Case Study #2

The Wayback County Jail is located in the northwestern United States, near a large metropolitan city where the health department has recently reported increased incidence rates of AIDS and tuberculosis in the community. Built with a design-rated capacity of 510, Wayback now has an average daily population of more than 600 inmates and will soon have more than 700. The facility was initially opened in 1913 with additional major construction occurring in the 1980's. The older housing is poorly lit and ventilated; the newer expansion consists of eight self-contained pods. The expansion relies heavily on the direct supervision philosophy of reducing inmate traffic within the jail: the only time an inmate leaves a pod is to go to court or the main medical facility, or to be transported to another facility (or released). No isolation units are located at this facility.

Wayback employs 300 persons, 200 of whom are correctional officers. Security staff work under three supervisory groups: one assigned to the old jail, one assigned to pods 1 through 4, and the other to pods 5 through 8. In addition, several persons work in the administrative section of the building: 9 administrators, 24 clerical and office support workers, and 48 professional, counseling, and education personnel. Nineteen maintenance and upkeep workers are assigned to various areas of the facility and rotate assignments periodically.

Controlling TB in Correctional Facilities

Skin-test data for employees (1994) reveal the following:

Unit	Total	Prior PPD+ (a)	Prior PPD Negative			
			Total (b)	Tested and Read (c)	PPD Converted (d)	Conversion Rate (d/c)
Pods 1–4	70	7	63	63	2	3.2 %
Pods 5–8	70	8	62	60	1	1.6 %
Old Jail	76	6	70	69	8	11.4 %
Administrative	84	7	77	77	1	1.3 %
Total	300	28	272	269	12	4.5 %

Category	Total	Prior PPD+ (a)	Prior PPD Negative			
			Total (b)	Tested and Read (c)	PPD Converted (d)	Conversion Rate (d/c)
Administrative	9	1	8	8	0	0.0
Security	200	18	182	180	9	5.0 %
Clerical	24	3	21	21	0	0.0
Professional	48	2	46	46	1	2.2 %
Maintenance	19	4	15	14	2	14.3 %
Total	300	28	272	269	12	4.5 %

Questions:

- 1) How should these data be interpreted? What additional information should the TB control official collect?

- 2) Wayback's TB control official and the city health department decide to conduct an evaluation of this possible transmission problem. What should the objectives of this investigation be?

Case Study #3

The Willie Maquet State Prison is a medium security prison housing male and female inmates, located in a large metropolitan area in the Midwest. The facility is extremely overcrowded; the design-rated capacity is 624, but the population recently has averaged 800 male offenders and 100 female offenders. The facility offers a large substance abuse treatment program and is the regional center for on-site specialty clinics for three other state prisons. This facility has a large population of handicapped and physically impaired inmates, as well as a large geriatric population (10% of inmates are 60 years of age or older). There are 57 HIV-infected patients receiving medications for HIV-related illnesses (e.g., aerosolized pentamidine); approximately 12% of inmates are known to be or suspected of being HIV-infected.

The following information was been collected for the first half of 1995 (reporting period January through June 1995):

Treatment for Inmates with TB Disease

Patients diagnosed during period

TB suspects: 4

Starting treatment: 4

Diagnosis confirmed: 4

Case rate: 444 per 100,000 inmates

Follow-up of patients diagnosed during 1994

Completing treatment: 100%

Note: 2 inmates started TB treatment between January and June of 1994. One remained in the facility and had completed treatment by the end of June 1995. One was released while still on treatment and successfully referred to the local health department.

Infection Control

Smear-positive cases: 3

TB isolation rooms available: 1

TB Infection in Staff

Skin-test positive persons at beginning of period: 27 of 292 (9.2%)

Skin-test conversions at end of period: 8 of 265 previously skin-test negative persons

Conversion rate: 3.0%

Controlling TB in Correctional Facilities

TB Infection in Inmates

Skin-test positive persons: 125 (19.8%)

Skin-test conversions: not available

Conversion rate: not available

Preventive Therapy (PT) for Infected Inmates

Patients starting PT during reporting period: 46

Follow-up of patients starting PT during 1994

Completing PT: 79% of 38 inmates

Note: 6 inmates who started PT between January and June 1994 were released or transferred out before completing therapy.

Follow-up of Inmates Released or Transferred Out

Status	Inmates with TB Disease	Inmates with TB Infection
Transferred out	0	4
Successfully referred to receiving facility	0	4 (100%)
Released	1	2
Successfully referred to health department	1 (100%)	0 (0%)

Question:

- 1) What components of Willie Maquet State Prison's TB control program could be improved?
How might this be done?

ANSWERS TO CASE STUDIES

Case Study #1

- 1) What problems contributed to delays in identifying and isolating this potentially infectious case of TB? How could these problems have been avoided?

Inadequate medical and clinical history: at entry on May 5, a more careful screening for symptoms might have picked up Walker's substantial weight loss. If questioned thoroughly about his medical history at that time, Walker might have revealed his previous skin-test result or hospitalization and treatment for TB.

Lack of an organized TB database: if the facility had an organized database (preferably in electronic form), Walker's previous skin-test result might have been found and prompted further evaluation of his cough.

Failure to determine if case had been previously reported: if registry cross-matching had been available from the county health department, Hard Rock might have found out sooner that Walker had TB disease. In the absence of cross-matching, correctional staff could have telephoned the county health department for information and consultation if they had suspected Walker's history of TB treatment.

Failure to place patient in isolation room when indicated: when Walker was referred to the medical unit on June 9, his symptoms were strongly suggestive of TB and he should have been referred to an isolation facility. Instead, he was kept in the infirmary, exposing staff who were caring for him or working in the adjacent corridor. When the smear results were reported positive for AFB on June 16, Walker should have been immediately referred to a local hospital with a TB isolation room; the administrative segregation cell is not adequate for this purpose. Medical staff at Hard Rock should receive training and education in recognizing symptoms suggestive of TB and in appropriate procedures for infection control.

Slow reporting methods by laboratory: the laboratory results should have been phoned or faxed to the facility and the physician of record, not mailed; this caused a delay of several days.

Lack of a collaborative agreement with the health department: Hard Rock should delegate a medical staff person to take the lead in controlling TB within the facility. That person should collaborate with the county health department to develop a written agreement for information exchange, consultation, and technical assistance. The Hard Rock TB control official could then work with the health department to improve TB control efforts.

2) What steps does Hard Rock need to take in carrying out a contact investigation?

Because Walker's AFB smear was positive, he should be considered infectious. Within the Hard Rock facility, the first place to start is Wing D, where Walker was incarcerated for 5 weeks while he was symptomatic. Walker's cellmate, the inmates in neighboring cells, and staff who worked on the same tier are at the highest risk of infection. Staff who work in the infirmary and inmates who stayed in the infirmary while Walker was held there should also be tested.

If skin test data shows evidence of transmission, the investigation should be broadened to include other inmates in Wing D, as well as staff who work in the administrative corridor. The county health department should identify and evaluate any community contacts Walker had prior to his incarceration in May. Staff and inmates in the satellite facilities do not need to be tested unless they worked or were housed in Wing D or the administrative corridor while Walker was potentially infectious. The county health department should help determine who should be tested, based on skin-test conversion rates among Walker's closest contacts and environmental factors such as air flow in the wings and administrative corridor.

3) Skin-testing of contacts revealed the following:

- 16 of 43 inmates on the upper tier of Wing D had positive skin-test results (37%)
- 6 of 12 staff working on the upper tier of Wing D had positive skin-test results (50%)
- 2 of 3 inmates housed in the infirmary had positive skin-test results (67%)
- 3 of 7 staff working in the infirmary had positive skin-test results (43%)

How should these data be interpreted? What should the next step be?

This represents a high proportion of skin-test positive contacts. The conversion rate can be calculated after discounting persons who had a documented positive skin-test result before this exposure occurred. For example, if 6 of the 16 skin-test positive inmates on Wing D had documented positive skin-test results, then the conversion rate in this group is

$$(16 - 6)/(43-6) \text{ or } 10/37 = 27\%$$

This is a very high conversion rate, and would warrant further skin-testing on Wing D and possibly on the administrative corridor as well. Again, the county health department should help determine who should be tested.

All skin-test positive persons should be evaluated for TB disease and, if disease is ruled out, considered for preventive therapy. In addition, any immunosuppressed persons who were potentially exposed while Walker was symptomatic should receive a thorough medical evaluation and should begin preventive therapy if TB disease is ruled out. Inmates or staff who were exposed but are no longer in the facility should be identified by Hard Rock so that the local TB program or other correctional facilities involved can locate and skin-test these persons.

Case Study #2

- 1) How should these data be interpreted? What additional information should the TB control official collect?

The skin test conversion rates in maintenance (14.3%) and security personnel (5.0%) are quite high when compared with rates in other groups. An unusually high conversion rate (11.6%) is also evident in the old jail. This situation may indicate a need for further epidemiologic investigation, based on

- the occurrences of skin-test conversions in staff members (especially in security officers and maintenance staff)
- the occurrence of possible person-to-person transmission of *M. tuberculosis* (especially likely in the old jail)

This may have been a situation in which an inmate or staff member with TB disease was not promptly identified and isolated, thus exposing other persons in the facility to *M. tuberculosis*.

Wayback's TB control official would want to interview those persons whose skin-test reaction has recently converted in order to determine more precisely their work locations and to question them about symptomatic persons. The TB control official would also want to review the medical records of inmates treated in the medical facility during or before 1992; in addition, TB screening data from inmates on entry might provide some helpful information. Wayback officials should consult with the county health department for assistance in analyzing this data and evaluating possible transmission in the facility.

- 2) Wayback's TB control official and the county health department decide to conduct an evaluation of this possible transmission problem. What should the objectives of this investigation be?

The general objectives of this investigation are as follows:

- to determine the likelihood that transmission of and infection with *M. tuberculosis* has occurred in the facility
- to determine the extent to which *M. tuberculosis* has been transmitted
- to identify those persons who have been exposed and infected, enabling them to receive appropriate clinical management and treatment
- to identify factors that could have contributed to transmission and infection and to implement appropriate interventions
- to evaluate the effectiveness of any interventions that are implemented and to ensure that exposure to and transmission of *M. tuberculosis* have been terminated

Wayback officials should consult with the health department for technical assistance in carrying out such an investigation and recommended policy changes to avoid future transmission problems. For more detailed information on conducting a problem evaluation and revising the facility's TB control plan, refer to section II-K of the CDC's "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-Care Facilities, 1994."³⁶

Case Study #3

- 1) Willie Maquet has a good success rate with the treatment of inmates diagnosed during 1994. However, the case rate for newly diagnosed cases is high and may indicate problems with intake screening or transmission within the facility. The TB control official may want to review records of all recent TB patients to determine
 - whether they were identified as infected or symptomatic through intake screening
 - whether their disease could be prevented by appropriate therapy
 - how long they were symptomatic before TB was suspected
 - whether treatment was promptly initiated
 - whether the single TB isolation room available is adequate for Willie Maquet's needs

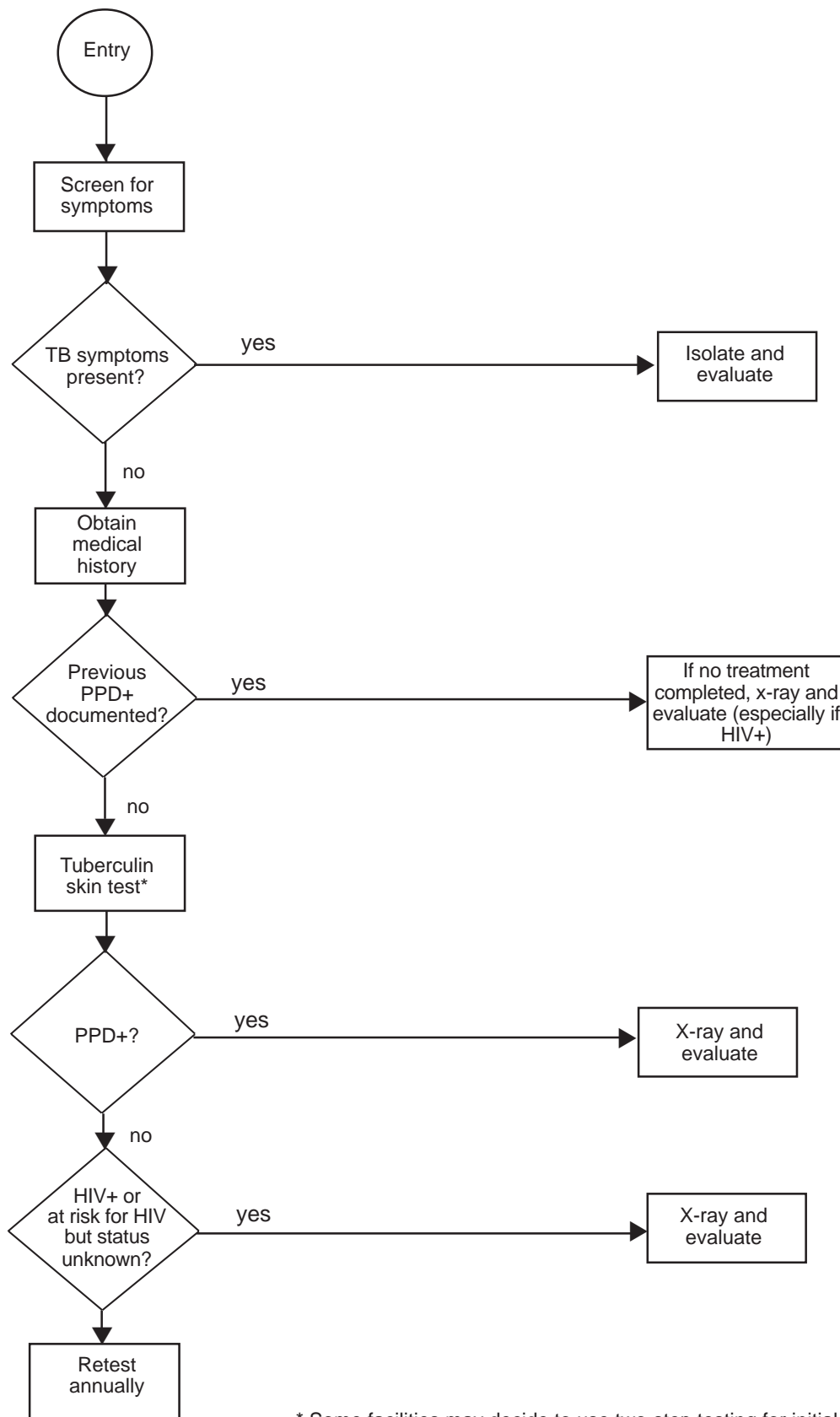
Skin-test conversions among staff could indicate a transmission problem, especially if they occur among several persons who work in the same area. No data were presented on preventive therapy among staff; the TB control official at Willie Maquet should monitor the initiation and completion of preventive therapy in this group.

No data on skin-test conversions among inmates are available. Long-term inmates should be receiving a repeat skin test annually; conversion rates in inmates can be used to help identify transmission problems. It is not clear on what basis inmates are starting preventive therapy. The TB control official should determine if appropriate priority is being given to high-risk groups. A preventive therapy completion rate of 79% is less than desired for an incarcerated population, especially in a facility with a high rate of HIV infection. Prison medical staff may want to review the records of inmates not completing preventive therapy to identify problems and correct policies and procedures, if necessary. In analyzing completion of preventive therapy, staff should consider looking at the results for immunosuppressed patients separately to make sure this high-priority group receives high priority.

Finally, the follow-up of inmates on preventive therapy who are released into the community could be improved. Willie Maquet's TB control officer may need to arrange a collaborative agreement with the local health department to coordinate a successful transfer of patients, their records, and their locating information. Many health departments have arranged for outreach workers to visit inmates before their release to establish a rapport with the inmates and develop follow-up plans for continuation of therapy.

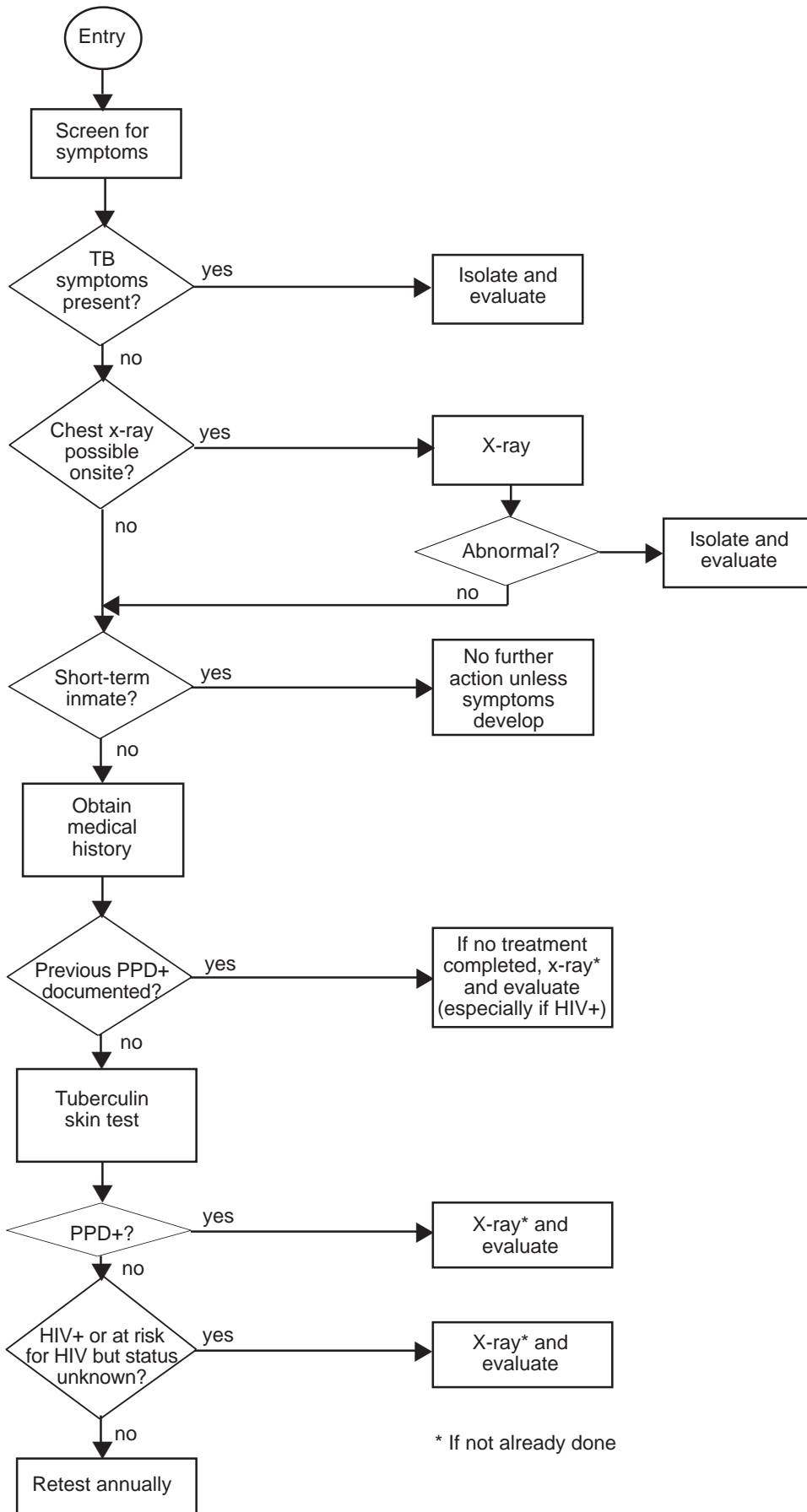
2. Screening Algorithms

1. Inmates in Long-Term Facilities

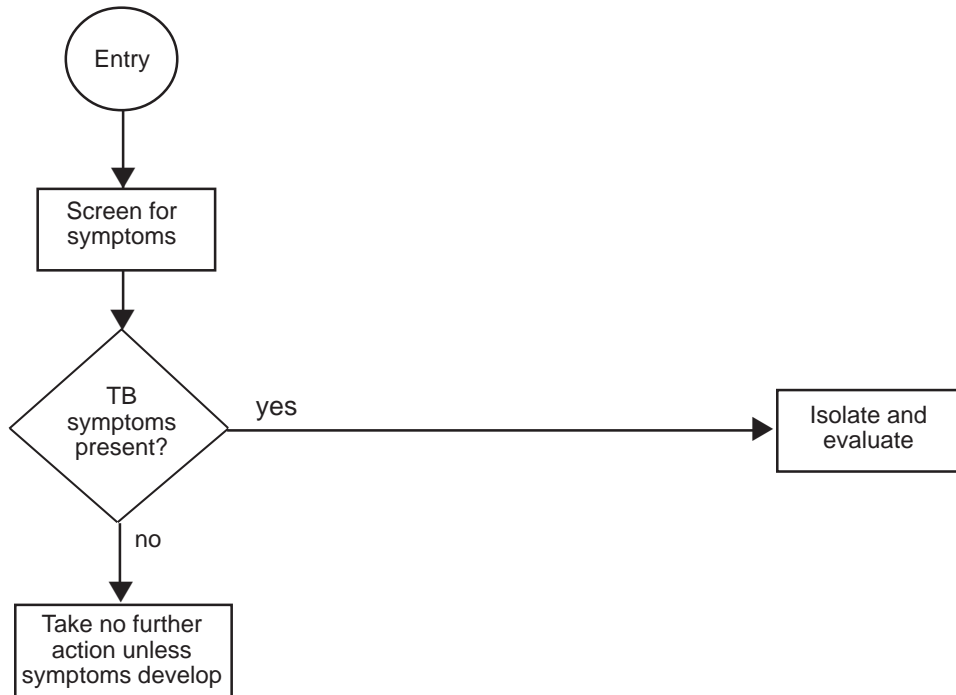


* Some facilities may decide to use two-step testing for initial testing

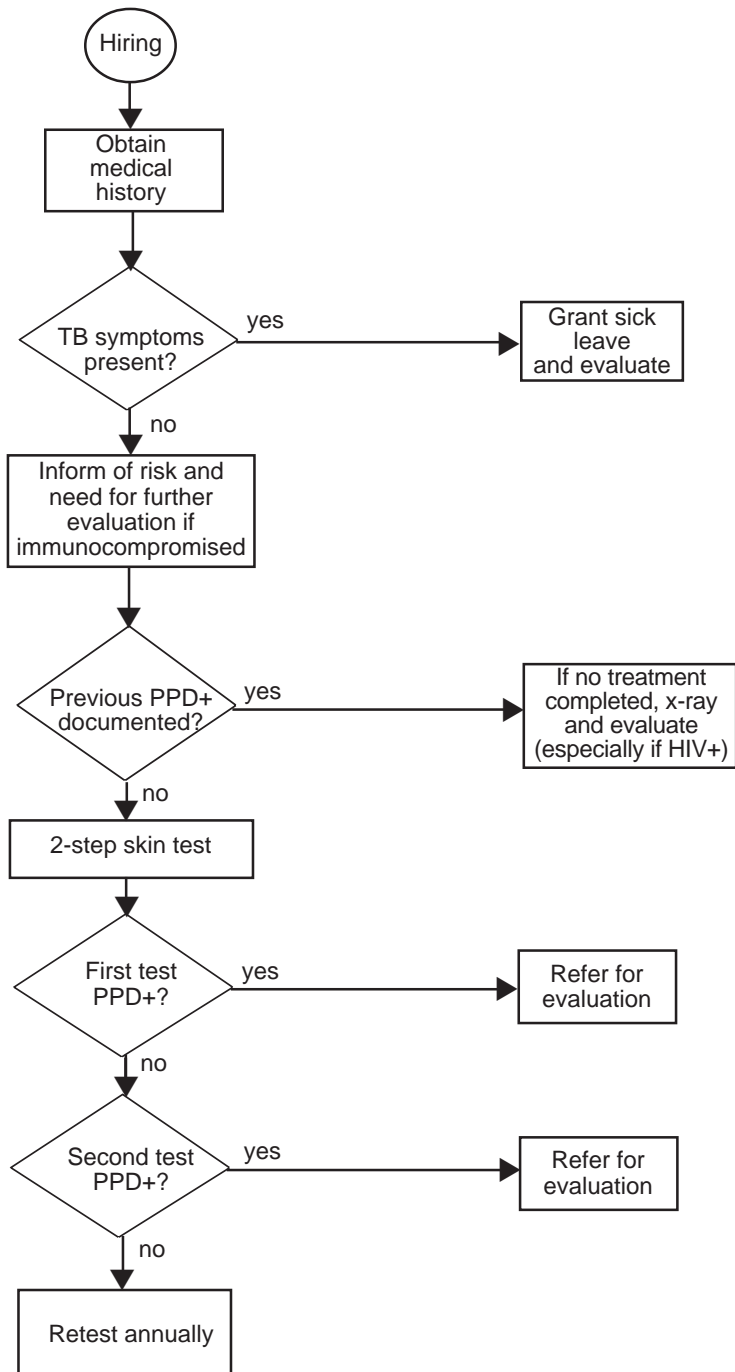
2. Inmates in Short-Term Facilities Serving High-Risk Populations



3. Inmates in Short-Term Facilities Serving Low-Risk Populations



4. Staff in All Correctional Facilities



3. Treatment Tables

Regimen Options for Treatment

Option	Indication	Total Duration (weeks)	Initial Phase		Continuation Phase		Comments
			Drugs	Interval and Duration	Drugs	Interval and Duration	
1	Pulmonary and extrapulmonary TB in adults and children	24	INH RIF PZA EMB or SM	Daily for 8 weeks	INH RIF	Daily or 2 or 3 times/ week ¹ for 16 weeks ²	EMB or SM should be continued until susceptibility to INH and RIF is demonstrated. In areas where primary INH resistance <4%, EMB or SM may not be necessary for patients with no individual risk factors for drug resistance.
2	Pulmonary and extrapulmonary TB in adults and children	24	INH RIF PZA EMB or SM	Daily for 2 weeks, then 2 times/ week ¹ for 6 weeks	INH RIF	2 times/week ¹ for 16 weeks ²	Regimen should be directly observed. After the initial phase, continue EMB or SM until susceptibility to INH and RIF is demonstrated, unless drug resistance is unlikely.
3	Pulmonary and extrapulmonary TB in adults and children	24	INH RIF PZA EMB or SM	3 times/week ¹ for 6 months ²			Regimen should be directly observed. Continue all four drugs for 6 months. ³ This regimen has been shown to be effective for INH-resistant TB.
4	Smear- and culture-negative pulmonary TB in adults	16	INH RIF PZA EMB or SM	Follow option 1, 2, or 3 for 8 weeks	INH RIF PZA EMB or SM	Daily or 2 or 3 times/ week ¹ for 8 weeks	Continue all four drugs for 4 months. If drug resistance is unlikely (primary INH resistance <4% and patient has no individual risk factors for drug resistance), EMB or SM may not be necessary and PZA may be discontinued after 2 months.
5	Pulmonary and extrapulmonary TB in adults and children when PZA is contraindicated	36	INH RIF EMB or SM ⁴	Daily for 4–8 weeks	INH RIF	Daily or 2 times/week ¹ for 28–32 weeks ²	EMB or SM should be continued until susceptibility to INH and RIF is demonstrated. In areas where primary INH resistance <4%, EMB or SM may not be necessary for patients with no individual risk factors for drug resistance.

Note. For all patients, if drug susceptibility results show resistance to any of the first-line drugs or if the patient remains symptomatic or smear or culture positive after 3 months, consult a TB medical expert.

¹ DOT should be used with all regimens administered two or three times weekly.

² For infants and children with miliary TB, bone and joint TB, or TB meningitis, treatment should last at least 12 months. For adults with these forms of extrapulmonary TB, response to therapy should be monitored closely. If response is slow or suboptimal, treatment may be prolonged as judged on a case-by-case basis.

³ There is some evidence that SM may be discontinued after 4 months if the isolate is susceptible to all drugs.

⁴ Avoid SM for pregnant women because of the risk of ototoxicity to the fetus.

First-Line TB Drugs

DRUG	Dose in mg/kg (Maximum Dose)						ADVERSE REACTIONS	MONITORING	COMMENTS
	Daily		2 Times/Week*		3 Times/Week*				
	Children	Adults	Children	Adults	Children	Adults			
INH	10-20 (300 mg)	5 (300 mg)	20-40 (900 mg)	15 (900 mg)	20-40 (900 mg)	15 (900 mg)	Hepatic enzyme elevation Hepatitis Peripheral neuropathy Mild CNS effects Drug interactions	Baseline measurements of hepatic enzymes for adults Repeat measurements – if baseline results are abnormal – if patient is at high risk for adverse reactions – if patient has symptoms of adverse reactions	Hepatitis risk increases with age and alcohol consumption Pyridoxine can prevent peripheral neuropathy
RIF	10-20 (600 mg)	10 (600 mg)	10-20 (600 mg)	10 (600 mg)	10-20 (600 mg)	10 (600 mg)	GI upset Drug interactions Hepatitis Bleeding problems Flu-like symptoms Rash	Baseline CBC measurements for adults of CBC, platelets and hepatic enzymes Repeat measurements – if baseline results are abnormal – if patient has symptoms of adverse reactions	Significant interactions with methadone, birth control pills, and many other drugs Colors body fluids orange May permanently discolor soft contact lenses
PZA	15-30 (2 gm)	15-30 (2 gm)	50-70 (4 gm)	50-70 (4 gm)	50-70 (3 gm)	50-70 (3 gm)	Hepatitis Rash GI upset Joint aches Hyperuricemia Gout (rare)	Baseline measurements for adults of uric acid and hepatic enzymes Repeat measurements – if baseline results are abnormal – if patient has symptoms of adverse reactions	Treat hyperuricemia only if patient has symptoms
EMB	15-25	15-25	50	50	25-30	25-30	Optic neuritis	Baseline and monthly tests of visual acuity and color vision	Not recommended for children too young to be monitored for changes in vision unless TB is drug resistant
SM	20-40 (1 gm)	15 (1 gm)	25-30 (1.5 gm)	25-30 (1.5 gm)	25-30 (1.5 gm)	25-30 (1.5 gm)	Ototoxicity (hearing loss or vestibular dysfunction) Renal toxicity	Baseline and repeat tests as needed of hearing and kidney function	Avoid or reduce dose in adults >60 years old

Notes. Children ≤ 12 years old

Adjust weight-based dosages as weight changes.

*All regimens administered 2 or 3 times a week should be used with DOT.

Controlling TB in Correctional Facilities

For general information and information specific to your area, please call your state or local health department TB program.

Telephone: _____

Contact Person: _____

For expert consultation on the management of drug-resistant TB, call

National Jewish Center for Immunology and Respiratory Medicine
Infection Disease Consultation Service
(303) 398-1279

New Jersey Medical School National Tuberculosis Center
(201) 982-3270

Francis J. Curry Tuberculosis Center
(415) 502-4700

New York Chest Clinic Model Tuberculosis Center
(212) 939-8403

For information on current policies and recommendations, call

Centers for Disease Control and Prevention
Division of Tuberculosis Elimination
(404) 639-3311

4. Information Systems

Sample Employee Form

Employee Tuberculin Screening

Name: Last: _____ First: _____ Middle: _____
 Street address: _____ Apt/PO Box: _____
 City: _____ State: _____ Zip: _____
 Birthdate: ___/___/___ SSN: _____ Sex: Male Female

Race/Ethnicity: White, not Hispanic Asian or Pacific Islander
 Black, not Hispanic American Indian or Alaskan Native
 Hispanic Other race, specify: _____

Were you born in the U.S.? (*Persons from outlying U.S. areas such as Puerto Rico, Guam, and the Virgin Islands should check No.*)

Yes No If no, country of birth: _____
 Year entered the U.S.: _____ or Don't know year

Have you ever received BCG vaccine? (*BCG, or bacille Calmette-Guérin, is a TB vaccine, not a PPD tuberculin skin test.*)

No Don't know Yes If yes, year received vaccine: _____

Have you ever had TB disease? Yes No Don't know
 Have you ever been exposed to a person with infectious TB disease? Yes No Don't know

Date employed (month/year): ___/___ Facility: _____
 Job title: _____ Full-time Part-time Contract

Work location since last form filled out: (*Check only one.*)

Work 75% or more of the time at one location. Specify: _____
 Work at multiple locations

Last documented PPD date: ___/___/___ Last PPD result: ___ mm Circle: Positive or Negative

Symptom evaluation: (*Answer Yes or No.*)

Persistent cough?	Weight loss?	Fever?	Night sweats?	TB suspected?	Education done?

If last PPD result negative, PPD skin test information:

Reason for test:

- Routine initial test. Give results of two-step testing on lines 1 and 2 below. (If documented PPD with negative result already done within 12 months, give single test only.)
 Routine follow-up test. Give result of single test on line 1 below.
 Contact investigation. Give result of baseline test on line 1, result of follow-up test on line 2.

Line	Brand/Lot #	Date given	Given by	Date read	Read by Result (mm)	Result (+ / -)
1						
2						

Referred for follow-up evaluation? Yes No

If yes, where: Employee health unit Local health department
 Personal physician Other, specify: _____

Employee's signature _____ Date _____

Sample Inmate Form

Inmate TB Summary Record

Facility: _____
 Contact person: _____
 Address: _____
 Phone: (____) _____ Fax: (____) _____

Personal Information

First name: _____ M.I.: _____ Last name: _____

Miscellaneous

Date of entry: ___/___/___ SSN: ___-___-___
 ID number: _____
 Date of birth: ___/___/___ Age: _____
 Cell number: _____

Last Known Address

Street: _____
 City: _____ State: _____
 Within city limits? ___ Zip: _____
 County: _____ Phone: (____) ___-___
 Contact person: _____

Race

White American Indian or Alaskan Native
 Black Asian or Pacific Islander

Ethnic Origin

Hispanic Non-Hispanic

Country of Origin United States

Other, specify: _____

Date entered U.S.: ___/___/___

Language

Understand English Speak English

Primary Language: _____

Symptom Screening Results

Productive, prolonged cough Chest pain Coughing up blood Loss of appetite
 Weight loss Night sweats Fever Chills Easy fatigability
 Other, specify: _____

Past Medical History

Condition	Yes	No	Unknown	Comments
Previous TB diagnosis				Year: _____ More than one episode?
Most recent TB skin test				Results: _____ Induration (mm): _____ Mo./Yr.: _____
BCG vaccination				Date: _____
Prior HIV test results				Results: _____ Mo./Yr.: _____
Diabetes				Insulin?
Hospitalized in last year				Where/Why
Current tobacco use				Amount (Cig/Day): _____
Silicosis				

Sample Assessment Forms

Screening Assessment Form

Employees

- Purpose: This form should be used to determine
- the number of employees screened for TB during initial and follow-up screening
 - the numbers of TB cases and candidates for preventive therapy identified through screening

Facility: _____

TB Control Official: _____

Assessment Period: from ____/____/____ to ____/____/____

Employees hired during period: _____

Screening on Hiring — Tuberculin Skin Testing

Action or finding	Number	Percentage	Comment
Total	a		All employees hired during the period should be included.
Documented prior positive	b		If no preventive therapy or treatment has been completed, these persons should be evaluated for preventive therapy.
Skin test administered on entry	c	$c/a \times 100$	All new employees without a documented prior positive skin test result should be included.
Positive skin-test result (using cutpoint of 10 mm or greater)	d		Persons with no risk factors for the development of TB if infected
Positive skin-test result (using cutpoint of 5 mm or greater)	e		Persons with suspected or confirmed HIV infection or radiographic evidence suggestive of old, healed TB These groups have high priority for preventive therapy.
Total with positive skin-test result	$f=b+d+e$	$f/a \times 100$	All new employees with a positive skin-test result should be included.
Referred for evaluation	g	$g/f \times 100$	All PPD-positive employees who have not completed a course of preventive therapy or treatment should be included.
Evaluation completed	h	$h/g \times 100$	To continue working, employees must submit documentation that infectious TB disease has been ruled out.
Referred for preventive therapy	i	$i/h \times 100$	Efforts should be made to ensure that employees adhere to, and eventually complete, preventive therapy; use Preventive Therapy Assessment Form if facility is providing preventive therapy to employees.
Active disease diagnosed	j		Persons with potentially infectious TB disease should be excluded from work until infectiousness has been ruled out and adherence documented.

(Continued on back)

Follow-up Screening — Tuberculin Skin Testing

Assessment Period: from ____/____/____ to ____/____/____

Employees eligible* for follow-up screening: _____

Action or finding	Number	Percentage	Comment
Total	a		All employees scheduled for follow-up appointments should be included.
Documented prior positive	b		A thorough symptom review should be done for these persons.
Skin test administered during assessment period	c	$c/a \times 100$	A skin test should be administered to all persons without a documented prior positive skin-test result (a - b).
Positive skin-test result (increase of 10 mm or greater)	d		Persons younger than 35 years of age
Positive skin-test result (increase of 15 mm or greater)	e		Persons 35 years of age or older
Total skin-test conversions	f=d+e	$f/c \times 100$	Conversion rate ($f/c \times 100$) should be compared with rates for areas or groups in which occupational exposure to <i>M. tuberculosis</i> is unlikely and with previous conversion rates in the same area or group. High-priority group for preventive therapy
Referred for evaluation	g	$g/f \times 100$	Should include all employees whose skin-test result has converted during the assessment period.
Evaluation completed	h	$h/g \times 100$	To continue working, employees must submit documentation that infectious TB disease has been ruled out.
Referred for preventive therapy	i	$i/h \times 100$	Efforts should be made to ensure that employees adhere to, and eventually complete, preventive therapy; use Preventive Therapy Assessment Form if facility is providing preventive therapy to employees.
Active disease diagnosed	j		Persons with potentially infectious TB disease should be excluded from work until infectiousness has been ruled out and adherence documented.

* Eligibility for follow-up screening depends on having completed initial screening and being due for a follow-up appointment during the assessment period.

Screening Assessment Form

Inmates

- Purpose: This form should be used to determine
- the number of inmates screened for TB during initial and follow-up screening
 - the numbers of TB cases and candidates for preventive therapy identified through screening

Facility: _____

TB Control Official: _____

Assessment Period: from ____/____/____ to ____/____/____

Inmates entering during period: _____

Initial Screening — Tuberculin Skin Testing

Action or finding	Number	Percentage	Comment
Total	a		All inmates entering the facility during the period should be included.
Documented prior positive	b		If no preventive therapy or treatment has been completed, these persons should be evaluated for preventive therapy.
Skin test administered on entry	c	$c/a \times 100$	All new inmates without a documented prior positive skin test result should be included.
Positive skin-test result (using cutpoint of 10 mm or greater)	d		Inmates with no risk factors for the development of TB
Positive skin-test result (using cutpoint of 5 mm or greater)	e		Inmates with suspected or confirmed HIV infection or radiographic evidence suggestive of old, healed TB These groups have high priority for preventive therapy.
Total with positive skin-test result	$f=b+d+e$	$f/a \times 100$	All new inmates with a positive skin-test result should be included.
Referred for evaluation	g	$g/a \times 100$	All PPD-positive inmates or inmates with chest x-ray suggestive of TB should be included unless preventive therapy or treatment has been completed previously.
Evaluation completed	h	$h/g \times 100$	High-priority groups should be placed on preventive therapy unless contraindicated.
Referred for preventive therapy	i	$i/h \times 100$	These inmates should be tracked with the Preventive Therapy Assessment Form.
Active disease diagnosed	j		Inmates with potentially infectious TB disease should be placed in TB isolation until infectiousness has been ruled out and DOT initiated.

(Continued on back)

Initial Screening — Chest Radiography

Action or finding	Number of inmates	Comment
Chest x-ray taken on entry	a	Should include, at a minimum, all HIV-infected persons.
Chest x-ray suggestive of TB	b	High-priority group for evaluation and, if TB disease is ruled out, preventive therapy; add these persons to "Referred for evaluation" (g) on the front.
Percentage with abnormal x-ray		Equals $b/a \times 100$.

Follow-up Screening — Tuberculin Skin Testing

Assessment Period: from ____/____/____ to ____/____/____

Inmates eligible* for follow-up screening: _____

Action or finding	Number	Percentage	Comment
Total	a		All inmates scheduled for follow-up appointments should be included.
Documented prior positive	b		A thorough symptom review should be done for these persons.
Skin test administered on entry	c	$c/a \times 100$	A skin test should be administered to all inmates without a documented prior positive skin-test result (a - b).
Positive skin-test result (increase of 10 mm or greater)	d		Inmates younger than 35 years of age
Positive skin-test result (increase of 15 mm or greater)	e		Inmates 35 years of age or older
Total skin-test conversions	f=d+e	$f/c \times 100$	Conversion rate ($f/c \times 100$) should be compared with previous conversion rates in the same group. High-priority group for preventive therapy
Referred for evaluation	g	$g/f \times 100$	Should include all inmates whose skin-test result has converted during the assessment period.
Evaluation completed	h	$h/g \times 100$	These persons are all considered high-priority for preventive therapy.
Referred for preventive therapy	i	$i/h \times 100$	These inmates should be tracked with the Preventive Therapy Assessment Form.
Active disease diagnosed	j		Inmates with potentially infectious TB disease should be placed in TB isolation until infectiousness has been ruled out and DOT initiated.

* Eligibility for follow-up screening depends on having completed initial screening, being due for a follow-up appointment during the assessment period, and having remained in the facility continuously.

Contact Investigation Assessment Form

Inmates and Employees

Purpose: This form should be used to determine the number of contacts to infectious cases of TB, the results of contact evaluation, and the number of contacts who start and complete preventive therapy.

Facility: _____

TB Control Official: _____

Assessment Period: from ____/____/____ to ____/____/____

Fill out this form 10 months after diagnosis of the index case		Pulmonary or laryngeal cases						Total pulmonary and laryngeal cases	
		Smear positive		Smear unknown		Smear negative		Number	Percent
		Number	Percent	Number	Percent	Number	Percent		
Number of cases	a								
Cases with contacts identified	b		$b/a \times 100$		$b/a \times 100$		$b/a \times 100$		$b/a \times 100$
Contacts identified	c		Contacts per case c/b		Contacts per case c/b		Contacts per case c/b		Contacts per case c/b
Contacts examined	d		$d/c \times 100$		$d/c \times 100$		$d/c \times 100$		$d/c \times 100$
PPD+ contacts without disease	e		$e/d \times 100$		$e/d \times 100$		$e/d \times 100$		$e/d \times 100$
PPD+ contacts with disease	f		$f/d \times 100$		$f/d \times 100$		$f/d \times 100$		$f/d \times 100$
PPD- contacts starting therapy	g		$g/(c-[e+f]) \times 100$		$g/(c-[e+f]) \times 100$		$g/(c-[e+f]) \times 100$		$g/(c-[e+f]) \times 100$
PPD+ contacts starting preventive therapy	h		$h/(e+f) \times 100$		$h/(e+f) \times 100$		$h/(e+f) \times 100$		$h/(e+f) \times 100$

(Continued on back)

Fill out this form 22 months after diagnosis of the index case	Treatment complete	Treatment not complete				Total	Completion rate
		Still on meds, refused, lost	Died	Left facility	Medical discharge		
	a	b	c	d	e	f = a+b+c+d+e	a/(a+b) x 100
PPD- contacts starting preventive therapy (See table on front)							
PPD+ contacts starting preventive therapy (See table on front)							
Total							

DEFINITIONS

Completion rate — total number of persons completing medications (a) divided by the total number starting medications (a+b) multiplied by 100.

Contact — any person who has shared the same air with a person who has infectious TB for a sufficient amount of time for transmission to have occurred.

Contacts examined — contacts who have a negative reaction to both tuberculin skin tests or who have a negative reaction to a tuberculin skin test administered 3 months after exposure to infectious TB disease has ended. Include also PPD-positive contacts and contacts with symptoms for whom evaluation (including a chest radiograph) is complete.

Contacts identified — contacts as defined above, excluding those with a prior positive skin test. Individuals should be counted only once in this report, even if they are contacts of more than one patient during the time period. This category does not include contacts already counted as cases who are currently being supervised.

Medical discharge — medications were discontinued by a physician due to adverse reactions.

PPD-negative contacts starting preventive therapy — Contacts with a tuberculin skin-test result less than 5 mm, for whom active TB disease has been ruled out.

PPD-positive contacts starting preventive therapy — PPD-positive contacts without disease who start preventive therapy.

PPD-positive contacts with disease — contacts with culture-positive TB disease or a clinical diagnosis of TB disease.

PPD-positive contacts without disease — contacts with a tuberculin skin-test result of 5 mm or greater, for whom active TB disease has been ruled out.

Preventive therapy completed — completion of preventive therapy is based on the regimen prescribed:

- if 6 months prescribed, completion is 135 doses within 10 months
 - if 9 months prescribed, completion is 80% of doses within 9 months
 - if 12 months prescribed, completion is 80% of doses within 12 months
- If twice-weekly therapy is given, each dose counts as 3.5 doses.

Smear negative — cases with respiratory specimens not demonstrating AFB on smear.

Smear positive — cases with at least one respiratory specimen that demonstrates any AFB on smear.

Smear unknown — cases for whom it is unknown if respiratory specimens were obtained for AFB smears or, if specimens obtained, results are unknown.

Treatment not complete — persons who have not completed 80% of the prescribed regimen of preventive therapy within the appropriate time frame. (See Preventive therapy completed.)

Preventive Therapy Assessment Form

Inmates

Purpose: This form should be used to determine by risk group the number of inmates who complete preventive therapy in the facility

Facility: _____

TB Control Official _____

Assessment Period: from ____ / ____ / ____ to ____ / ____ / ____

		Total	HIV-infected	Other high-risk groups ¹	Inmates younger than 35 years of age with no TB risk factors	Inmates 35 years of age or older with no TB risk factors ²
PPD-positive inmates						
Preventive therapy started	a					
Preventive therapy completed	b					
Exclusions	Died	c				
	Released or transferred out ³	d				
	Treatment stopped by physician	e				
Percentage completing preventive therapy Equals $b/(a-[c+d+e]) \times 100$						

¹ This group includes:

- persons who inject drugs
- persons with medical conditions known to increase risk for the development of TB disease
- persons who have chest radiograph findings suggestive of previous TB

² Because their risk for hepatic injury during treatment outweighs their estimated lifelong benefit from preventive therapy, persons in this group are not candidates for preventive therapy unless recently infected.

³ Facilities should monitor the percentage of inmates released or transferred out of the system who keep their scheduled referral appointment.

TB Treatment Assessment Form — Part I

Inmates

- Purpose: This form should be used to determine
- the number of inmates who complete treatment for TB disease in an appropriate time frame*
 - the rate of cure, as indicated by documented culture conversion to negative

Facility: _____

TB Control Official: _____

Assessment Period: from ____/____/____ to ____/____/____

Cases reported from facility (1)= _____

Cases entering facility (2)= _____

Cases reported at death (3)= _____

Cases never started on therapy (4)= _____

Cases leaving facility (5)= _____

Total cases ([1 + 2] - [3 + 4 + 5])= _____

DEFINITIONS (Used in table on back)

All cases — the total of the pulmonary section added to the total of the extrapulmonary section.

Assessment period — The time period during which cases included in the assessment were diagnosed. The date of diagnosis is

- the date TB medications were started
- the date the first positive specimen was collected (if medications were not started)
- the date the clinician makes the diagnosis of TB (if medications were not started and there is no positive specimen).

Completion rate — the number of cases classified as adherent for the duration of their recommended therapy divided by the total number of patients, minus the exclusions (died or left adherent) multiplied by 100.

Died or left adherent — cases occurring in inmates who died or left the facility during the course of therapy and both (1) did receive at least 80% of prescribed doses that could have been taken before that time and (2) did not miss more than 14 consecutive days of assigned medications (for reasons other than a medical discontinuation of therapy).

Died or left not adherent — cases occurring in inmates who died or left the facility during the course of therapy and either (1) did not receive at least 80% of prescribed doses that could have been taken before that time or (2) missed more than 14 consecutive days of assigned medications (for reasons other than a medical discontinuation of therapy).

Leaving facility — cases occurring in inmates who are released or transferred out from the facility. It is essential that the facility collaborate with the health department or receiving facility that will be handling the case to ensure a successful transfer of case management and continuation of therapy.

Susceptibility unknown — cases for which a positive culture was not obtained for susceptibility testing, susceptibility results were unknown, or susceptibility testing was not done.

Treatment complete, conversion documented — cases for which an appropriate course of multidrug therapy was completed, at least three consecutive negative sputum specimens were collected on different days, and there has been no evidence of failure or relapse for the remainder of therapy.

Treatment complete, conversion not documented — cases for which an appropriate course of multidrug therapy was, but sputum conversion has not been documented.

Treatment not complete, adherent — cases for which therapy is continuing but not yet complete, 80% of prescribed doses are received, and no more than 14 consecutive days of treatment have been missed (for reasons other than a medical discontinuation of therapy).

Treatment not complete, not adherent — cases for which therapy is not yet complete and 80% of prescribed doses have not been received or more than 14 consecutive days of medication have been missed; also includes cases in patients who are lost or refuse care.

* Appropriate duration of therapy is determined by drug susceptibility results and therapy prescribed. (See tables in Appendix 3.)

To be filled out 1 year after assessment period, for cases that were diagnosed within the period		Treatment complete		Treatment not complete			Total	Completion rate	
		Conversion documented	Conversion not documented	Adherent	Not adherent	Died or left* not adherent			Died or left* adherent (excluded)
		a	b	c	d	e			f
Pulmonary	INH- and RIF-susceptible								
	INH-resistant, RIF-susceptible								
	INH- and RIF-resistant								
	Susceptibility unknown								
	Total								
Extra-pulmonary (only)	INH- and RIF-susceptible								
	INH-resistant, RIF-susceptible								
	INH- and RIF-resistant								
	Susceptibility unknown								
	Total								
All cases									

* Released or transferred out of the facility

TB Treatment Assessment Form — Part II

Inmates

- Purpose: This form should be used to determine
- the number of inmates who complete treatment for TB disease in an appropriate time frame*
 - the rate of cure, as indicated by documented culture conversion to negative

Facility: _____

TB Control Official: _____

Assessment Period: from ____/____/____ to ____/____/____

Cases reported from facility (1)= _____

Cases entering facility (2)= _____

Cases reported at death (3)= _____

Cases never started on therapy (4)= _____

Cases leaving facility (5)= _____

Total cases ([1 + 2] - [3 + 4 + 5])= _____

DEFINITIONS (Used in table on back)

All cases — the total of the pulmonary section added to the total of the extrapulmonary section.

Assessment period — The time period during which cases included in the assessment were diagnosed. The date of diagnosis is

- the date TB medications were started
- the date the first positive specimen was collected (if medications were not started)
- the date the clinician makes the diagnosis of TB (if medications were not started and there is no positive specimen).

Completion rate — the number of cases classified as adherent for the duration of their recommended therapy divided by the total number of patients, minus the exclusions (died or left adherent) multiplied by 100.

Died or left adherent — cases occurring in inmates who died or left the facility during the course of therapy and both (1) did receive at least 80% of prescribed doses that could have been taken before that time and (2) did not miss more than 14 consecutive days of assigned medications (for reasons other than a medical discontinuation of therapy).

Died or left not adherent — cases occurring in inmates who died or left the facility during the course of therapy and either (1) did not receive at least 80% of prescribed doses that could have been taken before that time or (2) missed more than 14 consecutive days of assigned medications (for reasons other than a medical discontinuation of therapy).

Leaving facility — cases occurring in inmates who are released or transferred out from the facility. It is essential that the facility collaborate with the health department or receiving facility that will be handling the case to ensure a successful transfer of case management and continuation of therapy.

Susceptibility unknown — cases for which a positive culture was not obtained for susceptibility testing, susceptibility results were unknown, or susceptibility testing was not done.

Treatment complete, conversion documented — cases for which an appropriate course of multidrug therapy was completed, at least three consecutive negative sputum specimens were collected on different days, and there has been no evidence of failure or relapse for the remainder of therapy.

Treatment complete, conversion not documented — cases for which an appropriate course of multidrug therapy was, but sputum conversion has not been documented.

Treatment not complete, adherent — cases for which therapy is continuing but not yet complete, 80% of prescribed doses are received, and no more than 14 consecutive days of treatment have been missed (for reasons other than a medical discontinuation of therapy).

Treatment not complete, not adherent — cases for which therapy is not yet complete and 80% of prescribed doses have not been received or more than 14 consecutive days of medication have been missed; also includes cases in patients who are lost or refuse care.

* Appropriate duration of therapy is determined by drug susceptibility results and therapy prescribed. (See tables in Appendix 3.)

To be filled out 1 year after assessment period, for cases that were diagnosed within the period		Treatment complete		Treatment not complete			Total	Completion rate	
		Conversion documented	Conversion not documented	Adherent	Not adherent	Died or left* not adherent			Died or left* adherent (excluded)
		a	b	c	d	e			f
Pulmonary	INH- and RIF-susceptible								
	INH-resistant, RIF-susceptible								
	INH- and RIF-resistant								
	Susceptibility unknown								
	Total								
Extra-pulmonary (only)	INH- and RIF-susceptible								
	INH-resistant, RIF-susceptible								
	INH- and RIF-resistant								
	Susceptibility unknown								
	Total								
All cases									

* Released or transferred out of the facility

5. National Commission on Correctional Health Care Contact Information

NATIONAL COMMISSION ON CORRECTIONAL HEALTH CARE

2105 N. Southport Chicago, Illinois 60614-4017 (312) 528-0818 Fax: (312) 528-4915

ABOUT THE NATIONAL COMMISSION ON CORRECTIONAL HEALTH CARE

The National Commission on Correctional Health Care (NCCHC) is a not-for-profit, 501(c)(3) organization committed to improving the quality of care in our nation's jails, prisons, and juvenile detention and confinement facilities. The Commission is supported by thirty-six national organizations representing the fields of health, law, and corrections, including the American Medical Association (AMA); the American Bar Association; the American Public Health Association; the National Sheriff's Association; and the American Association of Public Health Physicians.

In the early 1970s, the AMA studied the conditions of health care in jails. Finding inadequate health services and a lack of national standards that left many correctional institutions' health care in disarray, the AMA, in collaboration with other organizations, established a program that eventually, in the early 1980s, became the National Commission on Correctional Health Care. The National Commission was the only organization of its kind to study and formulate policy for a floundering area clearly in need of assistance.

Today, the National Commission's leadership in setting standards for health services and improving health care in correctional facilities is widely recognized. NCCHC's *Standards for Health Services* are written for prisons, jails, and juvenile detention and confinement facilities. The standards represent NCCHC's recommended minimum requirements for the management of a correctional health services system, covering the general areas of administration, personnel, care and treatment, health records, and medical-legal issues. The standards have helped the nation's correctional and detention facilities increase the efficiency of their health services delivery; strengthen their organizational effectiveness; improve the overall health protection of their inmates and staff; and reduce their risk of adverse legal judgments.

The National Commission continues to be the only organization devoted solely to establishing standards, providing technical assistance to correctional health care providers, and developing and publishing research on the correctional health care field. In addition to the institutional support that it provides, NCCHC has developed several programs to foster professionalism in this field. The Commission operates the national certification program for correctional health professionals; sponsors major conferences on correctional health care; provides a variety of educational trainings; and has published numerous support texts. Finally, NCCHC aids both individuals and institutions through its technical assistance programs that are designed to review the overall health services at an institution and provide consultation in such areas as staffing patterns, utilization review, trend analysis, and quality assurance and improvement.

NATIONAL COMMISSION ON CORRECTIONAL HEALTH CARE

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SUPPORTING ORGANIZATIONS

American Academy of Child & Adolescent Psychiatry
American Academy of Family Physicians
American Academy of Pediatrics
American Academy of Physician Assistants
American Academy of Psychiatry & the Law
American Association of Medical Specialties
American Association of Public Health Physicians
American Bar Association
American College of Emergency Physicians
American College of Healthcare Executives
American College of Neuropsychiatrists
American College of Physicians
American Correctional Health Services Association
American Counseling Association
American Dental Association
American Diabetes Association
American Dietetic Association
American Health Information Management Association
American Jail Association
American Medical Association
American Nurses Association
American Osteopathic Association
American Pharmaceutical Association
American Psychiatric Association
American Psychological Association
American Public Health Association
American Society for Addiction Medicine
John Howard Association
National Association of Counties
National Association of County Health Officials
National Council of Juvenile & Family Court Judges
National District Attorneys Association
National Juvenile Detention Association
National Medical Association
National Sheriffs' Association
The Society for Adolescent Medicine