

# Preface

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## About the Francis J. Curry National Tuberculosis Center

One of four regional tuberculosis training and medical consultation centers (RTMCC) funded by the Centers for Disease Control and Prevention (CDC), the Francis J. Curry National Tuberculosis Center (CNTC) is a joint project of the San Francisco Department of Public Health and the University of California, San Francisco. CNTC creates, enhances, and disseminates state-of-the-art resources and models of excellence to control and eliminate tuberculosis (TB) nationally and internationally. Committed to the belief that everyone deserves the highest quality of care in a manner consistent with his or her culture, values, and language, CNTC 1) develops and delivers versatile, culturally appropriate trainings and educational products, 2) provides technical assistance, and 3) provides medical consultation.

## Purpose of the Tuberculosis Infection Control Manual

The Tuberculosis Infection Control Manual is designed to provide information about TB infection control to clinics, homeless shelters, hospitals, and other interested parties. The goal of this manual is to provide consistent and up-to-date information about the guidelines and regulations pertaining to TB infection control, methods of reducing the risk of TB infection, and facility-specific guidelines for reducing the risk and dealing with potential TB exposure.

Before the publication of this manual, information about the potential risk of TB infection in various facilities, ways to reduce the risk of infection, and engineering details were provided in multiple CNTC products. Each product provided specific information for its topic with no single document covering all of these aspects. The following five products have been combined and updated to form this manual:

- Tuberculosis Exposure Control Plan: Template for the Clinic Setting
- Conducting Sputum Induction Safely
- Isolation Rooms: Design, Assessment and Upgrade
- A Guideline for Establishing Effective Practices: Identifying Persons with Infectious TB in the Emergency Department
- TB in Homeless Shelters: Reducing the Risk through Ventilation, Filters, and UV

The “Tuberculosis Infection Control Plan Template for Jails” (published 2001) is currently available from CNTC (product number WPT-09C) and is not included in this manual. Much of the content for the original products was researched and compiled by the Institutional Consultation Services (ICS), a component of CNTC that is no longer active. ICS staff had expertise and practical experience in infection control, occupational health, and mechanical engineering, and provided telephone and on-site consultations to TB control staff of

high-risk institutions, including health-care facilities, and shelters. While the ICS no longer exists, their work is an integral part of this document.

This manual was developed in an effort to compile all of the information into one cohesive document, making it easier to:

- Understand how TB is spread
- Understand how ventilation, filters, and UVGI can help reduce the spread of TB
- Evaluate and improve ventilation
- Use filters and UVGI to reduce the risk that TB will spread

In addition, this manual provides facility-specific procedures for TB infection control, making it easier to:

- Understand the special needs and requirements of each facility type
- Sustain TB control measures to ensure their effectiveness
- Make informed decisions regarding planning, funding, and selection of ventilation equipment, filters, and UVGI
- Learn the essential elements of a safe sputum induction program
- Learn the design and regulatory requirements for airborne infection isolation rooms (AIIRs)

## Who Should Use This Manual

The primary audience for this manual includes:

- Directors and facility managers of the following health-care facilities:
  - Community and public health clinics
  - Hospital emergency departments, and
  - Homeless shelters
- TB/infection control program managers in public health departments

Secondary audiences for this document are:

- Public health nurses and community health nurses
- Staff of homeless shelter funding sources, such as governmental agencies and community-based organizations
- Homeless shelter designers, such as architects and engineers
- Others who work in or may provide services to health-care facilities or shelters:
  - Medical staff, such as on-site clinic and TB screening staff
  - Environmental health inspectors and occupational health inspectors
  - Engineering staff
  - Building inspectors
  - Advocates and educators
  - Caseworkers
- Other interested parties

# How This Manual Is Organized

This manual is divided into the following sections:

- **Acknowledgements:** Lists the people, facilities and organizations who helped make this manual possible
- **Abbreviations:** Lists the abbreviations used in the manual
- **Part I:** Contains general information about the manual, TB disease, and regulations, including:
  - Background about the manual and how to use it
  - The intended audience
  - Descriptions of TB and transmission of *M. tuberculosis*
  - Information about how to reduce the risk of spreading the disease
  - Engineering details for the implementation of systems
  - Review of the current CDC guidelines
  - Description of other applicable guidelines and regulations
- **Part II:** Contains more specific information about TB infection control in various settings:
  - Clinics, especially TB clinics where the following are found:
    - Sputum Induction booths/rooms
    - AIRs
  - Hospital emergency departments
  - Homeless shelters
- **Appendices:** This section contains forms and worksheets that help in the assessment of risk; provides a tracking mechanism for training and triage criteria, among other items; and provides formulas to calculate conversion rates and room clearance times. Also included are a description of air change, and “Cover Your Cough” and room clearance signs.
- **Glossary:** Provides definitions of the terms used in the manual
- **Resources:** This section contains a list of the guidelines, educational materials, services, and web sites mentioned in this document. Additional resources are also supplied.
- **References:** This section contains a list of the documents referenced in the manual.

# How to Use This Manual

1. Review the table of contents to get an overview of the manual contents. Note the titles of the appendices for future reference.
2. Read the introduction. This section contains information on how TB is spread and drug resistance.
3. Read “Guidelines and Regulations.” This section contains information from the CDC, AIA, OSHA, and Cal/OSHA.
4. Read the “Environmental Controls” section to understand how filters, UVGI, and ventilation should be implemented..
5. For detailed information, read the section that corresponds to your needs or setting:
  - Clinics (page 49)
  - Sputum Induction (page 73)
  - AIRs (page 87)
  - Hospital Emergency Departments (page 113)
  - Homeless Shelters (page 131)
6. As you read this manual, refer to the Glossary for definitions of terms used in the document, and Resources and References to see which works were referenced in a passage, and to learn about resources from which you can obtain additional materials.

## About the Use of “TB” and “*Mycobacterium tuberculosis*” in this Document

In this document, the terms “TB” and “*Mycobacterium tuberculosis*”/“*M. tuberculosis*”/“*M. tb*,” (the germ that causes TB) are used in different ways. It is technically correct to use “TB” only in reference to the disease (i.e., TB disease). Likewise, it is correct to use *M. tuberculosis* with the words exposure, infection, disease, and transmission (for example, “*M. tuberculosis* exposure,” “*M. tuberculosis* infection,” “*M. tuberculosis* disease,” and “*M. tuberculosis* transmission”). To reflect common usage, this document uses “TB” with these words, instead of *M. tuberculosis* (for example, “TB exposure,” “TB infection,” “TB disease,” and “TB transmission”). *M. tuberculosis* is used in this document only to describe particles that a person with TB disease of the lungs or larynx expels from the lungs.

# Introduction

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## How Tuberculosis (TB) Is Spread

TB is caused by bacteria (a type of germ) called *Mycobacterium tuberculosis* (*M. tuberculosis*). A person who has TB disease in his or her lungs or larynx (throat) can release tiny particles called droplet nuclei into the air by coughing, sneezing, singing, shouting, talking, or breathing.

These particles are invisible to the naked eye and are approximately 1 to 5 microns in size. (A micron is approximately one-hundredth the width of a human hair.) Droplet nuclei can remain airborne in room air for a long period of time, until they are removed by natural or mechanical ventilation.

In order for TB to spread, there must be a source patient who has infectious TB disease and a susceptible host (a person to inhale droplet nuclei containing *M. tuberculosis*). Anyone who shares air with a person with infectious TB disease of the lungs or larynx is at risk, although TB is not usually spread by brief contact. TB is spread when another person inhales one or more of these particles and becomes infected with TB.

## The Difference Between TB Infection and TB Disease

### Latent TB Infection (LTBI)

Latent TB infection (LTBI) does not cause a person to feel sick, and there are no symptoms.

Tuberculin skin tests (TSTs) or interferon gamma release assay (IGRA) blood tests are used to diagnose LTBI. A positive result means that TB infection is present.

Treatment for LTBI is effective in preventing persons with LTBI from developing TB disease.

Nine in ten people with a normal immune system with LTBI will never develop TB disease. However, one in ten of those infected will develop TB disease at some time in their lives, though the risk is lower if they receive preventive therapy. About half of these will develop TB disease within the first 2 years after they become infected.

There is no way to determine which people with LTBI will later get sick with TB disease. The following persons are at high risk for progressing from LTBI to TB disease:

- Persons infected with HIV and other diseases, such as diabetes and renal conditions that require dialysis, that weaken the immune system
- Persons infected with *M. tuberculosis* within the previous 2 years
- Infants and children <4 years old
- Persons who receive medical treatments, such as certain cancer treatments or prolonged steroid use, that weaken the immune system
- Persons with a history of untreated or inadequately treated TB disease

## TB Disease

Most TB disease occurs in the lungs, but about 15% occurs in other parts of the body (e.g., bone, eye, and brain). General symptoms of pulmonary TB include:

- Cough
- Fever
- Night sweats
- Fatigue
- Unexplained weight loss
- Hemoptysis (bloody sputum)

Without treatment, a person with TB disease will get sicker. A person with untreated pulmonary TB disease of the lungs or larynx will also become more contagious. Untreated TB can become a life-threatening disease; however, with effective and complete treatment, TB can be cured.

A person with a cough lasting 3 or more weeks along with any other symptoms of TB disease (fever, night sweats, fatigue, unexplained weight loss, hemoptysis [bloody sputum]) should be evaluated by a healthcare provider as soon as possible. If TB disease is diagnosed or suspected, treatment will be prescribed.

## When TB is Infectious

With rare exceptions, TB is infectious only when it occurs in the lungs or larynx. TB that occurs elsewhere in the body is usually not infectious, unless the person also has TB in the lungs or larynx at the same time.

In general, a person with suspected or confirmed TB disease of the lungs or larynx should be considered infectious until the person has:

- 1.** Had three negative acid-fast bacilli (AFB) sputum smear results obtained 8-24 hours apart, with at least one being an early morning specimen (an AFB sputum smear is a type of medical test used in the diagnosis of TB); and
- 2.** Shown to have clinical improvement as a result of antituberculosis treatment (for a minimum of 2 weeks) that is based on susceptibility results,
- 3.** Been determined to be noninfectious by a physician knowledgeable and experienced in managing TB disease.

A person who has met all three of the above conditions must continue to take TB medications as prescribed and continue to receive medical care for TB.

# Drug-resistant TB

Drug-resistant TB is a growing global problem and is more difficult and expensive to treat and cure. Like “regular” drug-susceptible TB, drug-resistant TB is airborne and is just as contagious. In addition, there is often a delay in recognizing drug-resistant TB that can lead to prolonged exposure, making it easier for TB to spread.

Drug resistance is divided into two types: primary resistance and secondary (or acquired) resistance. Primary resistance occurs when a person gets infected with TB that is already resistant. We would know this because they were never treated for TB before. Secondary resistance occurs during treatment for tuberculosis, because the doctor prescribes inadequate treatment, patients with TB stop their treatment prematurely, or take their medicine sporadically.

Preventing drug-resistance is very important. When medications are not taken as prescribed or the treatment regimen is inadequate (such as therapy with a single drug), drug-resistant organisms emerge and take over. Therefore, patient adherence to a prescribed course of therapy and treatment with multiple drugs are essential factors in preventing the emergence of drug resistance.

## Multidrug-resistant TB (MDR TB)

MDR TB is tuberculosis disease caused by *M. tuberculosis* that is resistant to the two most effective and important TB drugs, Isoniazid (INH) and Rifampin (RIF). MDR TB became a major concern in the US in the early 1990s when outbreaks occurred in seven hospitals in New York, New Jersey, and Florida. These outbreaks involved immunocompromised, HIV-infected patients and inmates in a state correctional system. Inadequate infection control practices and prolonged infectiousness contributed to significant transmission in these facilities and resulted in TB infection, TB disease, and death among a significant number of patients and staff.

CDC has published recommendations for prevention of MDR TB and for the treatment and management of MDR TB cases and their contacts. Consultation with medical and nursing experts who are knowledgeable and experienced in MDR TB case/contact management is essential.

## Extensively Drug-resistant TB (XDR TB)

XDR TB, or extensively drug-resistant TB, is now being recognized as a serious and growing problem. In many developing countries, this form of TB is untreatable. The CDC first published a report in March 2006 entitled, “Emergence of *M. tuberculosis* with extensive resistance to second-line drugs, worldwide, 2000-2004.” The findings in the report indicated that XDR TB has worldwide distribution, including within the US, and has worse treatment outcomes than MDR TB. The report concluded that new TB drugs and better tests for detection are urgently needed.

XDR TB is a severe form of MDR TB where resistance extends beyond Isoniazid and Rifampin and includes resistance to the 2 most important drugs used in treating MDR TB. These cases are often resistant to up to 9 drugs when diagnosed.

*Consultation with medical and nursing experts who are knowledgeable and experienced in MDR TB case/contact management is essential.*