

# Tuberculosis



## Section 1:

### ABOUT THE DISEASE

#### A. Etiologic Agent

Tuberculosis (TB) is caused by bacteria (tubercle bacilli) that make up the *Mycobacterium tuberculosis* complex. There are five closely related organisms in the complex: *M. tuberculosis* (*M. tb*), *M. bovis*, *M. africanum*, *M. microti* and *M. canetti*. Other mycobacteria occasionally produce disease clinically indistinguishable from tuberculosis. *M. tb* causes virtually all TB in the U.S.

#### B. Clinical Description

<b>Latent TB Infection</b>	<p>TB infection involves a small number of TB bacteria living in the body in a latent, or dormant, state without causing harm. The term for this is “latent TB infection” (LTBI). As long as the immune system remains vigorous, TB stays dormant, walled up in small structures created by the immune system (granuloma). Most individuals with LTBI never become ill with TB disease. The only manifestation of LTBI is a positive tuberculin skin test reaction. Those with LTBI do not feel sick, and they have no symptoms. They are not infectious, and therefore cannot spread the infection to others. However, individuals with LTBI remain at risk of developing active TB disease throughout their lifetime.</p>
<b>TB Disease</b>	<p>Active TB is an infectious disease that occurs when these dormant or latent TB organisms begin to multiply in a person. TB can affect any part of the body, but usually affects the lungs (where it is called pulmonary TB). Systemic symptoms of TB disease include fever, fatigue, weight loss, and night sweats. Signs and symptoms specific to pulmonary TB include cough (progressing from nonproductive to productive); in advanced stages, blood-tinged sputum (hemoptysis); and an abnormal chest radiograph, progressing from infiltrates to open cavities as the disease progresses untreated. Symptoms of extra-pulmonary TB (TB outside the lungs) are related to the specific organ or tissue involved. However, symptoms need not be present, or the patient may deny or fail to recognize symptoms and still be ill with TB. Demonstration of acid-fast bacilli (AFB) in stained smears from sputum or other bodily fluids or tissues makes a presumptive diagnosis of TB and warrants initiation of treatment. Definitive diagnosis is based on positive cultures for <i>M. tuberculosis</i> complex organisms.</p>

#### C. Vectors and Reservoirs

Humans are the most common source of infection, but other mammals have been known to harbor the organism (e.g., monkeys, dogs). In some areas, diseased cattle, badgers, and swine are also infected. Human infection with *M. bovis*, the bovine tubercle bacillus, is still a problem in areas where the disease in cattle has not been controlled and where milk and milk products are consumed raw.

## D. Modes of Transmission

TB is transmitted from person to person through the air by droplet nuclei (small particles 1–5 micrometers in size; smaller than a red blood cell: 7µm), generated by persons with infectious TB. Droplet nuclei are produced when persons with pulmonary or laryngeal TB cough, sneeze, speak, or sing. They may also be produced by procedures, such as sputum induction, bronchoscopy, suctioning, or vigorous wound irrigation that produce aerosols. Except for rare circumstances, persons with TB disease outside the lungs (extrapulmonary) are not infectious. Infection occurs when persons have prolonged or repeated close exposure to an infectious person, with shared air space, and they inhale the organisms.

## E. Incubation Period

The time from initial infection to a positive tuberculin skin test reaction is about 2–12 weeks. Approximately 10% of individuals who acquire LTBI and who do not take a course of preventive treatment, will develop active TB disease. While the risk of progression to TB disease is greatest within the first two years after infection, latent infection may persist for a lifetime. HIV infection and other cell-mediated conditions that impair immunity increase the risk and shorten the interval from infection to the development of TB disease. The risk of progression for persons co-infected with TB and HIV is 7–10% per year versus a lifetime risk of 5–10% otherwise. The risk of developing TB is also greater for children under two years of age. A positive tuberculin skin test usually persists, regardless of treatment.

## F. Period of Communicability or Infectious Period

Only adults with TB of the lungs or other parts of the respiratory tract are usually infectious. Factors affecting the degree of infectiousness include: the number of bacilli expelled into the air, virulence of the organism, adequacy of ventilation, exposure of bacilli to sun or ultraviolet radiation, and opportunities for aerosolization through coughing, sneezing, talking or singing, or during procedures. Effective treatment usually eliminates communicability within 2–4 weeks, even though TB bacteria may still be seen in or may grow from expectorated sputum. Virulence of the TB organism and susceptibility of the host also play a role in transmission. Medical conditions such as HIV infection, other immune system compromise, or malnutrition increase one's risk of being infected, if exposed.

Although transmission has been known to occur, children are generally not infectious.

## G. Epidemiology

Worldwide, TB remains one of the deadliest diseases. One-third of the world's population, almost two billion people, is infected with *M. tuberculosis*. The World Health Organization (WHO) estimates 8 million people develop TB disease and 2 million die from TB each year, accounting for 7% of all deaths in the world and more than 25% of preventable deaths.

Since 1953, the U.S. TB case rate has declined tenfold to a rate of 5.1/100,000 population in 2003. The number of TB cases reported in 2003 represented a 44% decrease from 1992, when the number of TB cases and the case rate peaked during the most recent resurgence of TB in the U.S. The resurgence of TB in the U.S. in the late 1980s and early 1990s was associated with the emergence of multi-drug resistant (MDR) TB and the HIV/AIDS epidemic. The overall decrease in cases in the last decade primarily reflects a decrease in the number of cases among U.S.-born persons, with substantial declines in all age groups. Over the last several years in Massachusetts, 75–80% of TB cases were non-U.S.-born persons, making non-U.S.-born persons the highest risk group for TB in the state.

## H. Bioterrorist Potential

This pathogen is not considered to be of risk for use in bioterrorism.



### Section 2:

## REPORTING CRITERIA AND LABORATORY TESTING

### A. What to Report to the Massachusetts Department of Public Health (MDPH)

#### *TB Disease*

Report any confirmed or clinically suspect case of active TB disease, as defined by *105 CMR 350.100*:

- ◆ A laboratory report of sputum or other bodily fluid or tissue found to contain tubercle bacilli, as evidenced by culture or other definitive diagnostic test, or suspected to contain tubercle bacilli as evidenced by smear; or
- ◆ Chest radiographic findings interpreted as active tuberculosis by a qualified physician.

In addition, report any clinically suspect case of active extra-pulmonary disease who has signs or symptoms consistent with TB disease in any tissue or organ outside the respiratory system.

#### *Latent TB Infection*

Report LTBI, as diagnosed by a positive tuberculin skin test performed with purified protein derivative (PPD) antigen by the Mantoux method, or by any other diagnostic test approved for this purpose by the federal Food and Drug Administration (FDA), that results in a reaction that represents a positive test according to the most recently published guidelines of the Centers for Disease Control and Prevention (CDC).

### B. Laboratory Testing Services Available

The MDPH State Laboratory Institute, Mycobacteriology Laboratory provides comprehensive diagnostic testing services for *M. tuberculosis*, including smear microscopy and conventional and rapid methods for acid fast bacilli culture, identification, antimicrobial susceptibility testing. In addition, case clustering analyses are performed with molecular fingerprinting methods (RFLP and VNTR) with prior approval from the TB Prevention and Control Program at (617) 983-6970. Each specimen submitted for testing to the SLI Mycobacteriology Laboratory will incur a \$15 testing fee.

**For more information on laboratory services, call the SLI Mycobacteriology Laboratory at (617) 983-6381.**



Section 3:

# REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

## A. Purpose of Surveillance and Reporting

<b>LTBI</b>	To identify persons with LTBI, to assess risk factors, and to ensure high-risk persons start and complete a course of treatment.
<b>Cases/Suspects</b>	To ensure that all cases of active TB, including those diagnosed elsewhere, are appropriately treated and to prevent the transmission of TB.
<b>Contacts</b>	To identify close contacts of infectious TB cases, to test and evaluate contacts as indicated, and to ensure infected contacts start and complete a course of treatment.

## B. Laboratory and Health Care Provider Reporting Requirements

TB infection or disease is reported directly to MDPH. The MDPH Division of TB Prevention and Control (DTBPC) is required to notify the patient's local board of health (LBOH) within 24 hours of the initial notification.

MDPH regulations (*105 CMR 300.180*) stipulate that any health care provider, laboratory, LBOH, or administrator of a city, state, private institution, or hospital must report directly to MDPH, each confirmed case of TB or clinically suspect case of TB, as defined by the reporting criteria in Section 2A. The report must be made within 24 hours using an official MDPH *TB Case/Suspect Reporting Form* (found at the end of this chapter).

**There is a convenient, 24-hour, toll-free, confidential TB case reporting line: 1-888-MASSMTB or (888) 627-7682.**

In addition, each diagnosis of LTBI, as defined by the reporting criteria in Section 2A, must be reported directly to MDPH using an official *MDPH Latent Tuberculosis Infection (LTBI) Case Report Form* (found at the end of this chapter).

After completing the form, attach laboratory report(s) and fax or mail (in an envelope marked "Confidential") to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS). The confidential fax number is (617) 983-6813. Call ISIS at (617) 983-6801 to confirm receipt of your fax. The mailing address is:

**MDPH, Office of Integrated Surveillance and Informatics Services (ISIS)  
 305 South Street, 5<sup>th</sup> Floor  
 Jamaica Plain, MA 02130  
 Fax: (617) 983-6813**

The DTBPC also requests that one positive culture isolate from each case of active TB be sent to the SLI for genotyping.

## C. Local Board of Health (LBOH) Reporting and Follow-up Responsibilities

### *Reporting Requirements*

If the LBOH receives a report of a potential TB case from the diagnosing health care provider, MDPH regulations (105 CMR 300.000) stipulate that each LBOH must report any case of TB or suspect case of TB to the MDPH *within 24 hours* (see Section 3B on how to make your report). It cannot be assumed that the diagnosing health care provider also reported the suspect case to the MDPH.

Any LBOH professional who identifies a person with LTBI, as defined by the reporting criteria in Section 3B, is responsible for reporting the case to the MDPH (see Section 3B on how to make your report).

### *Case Investigation*

LBOH are required by MDPH regulation (105 CMR 365.200: *Case Management*) to designate a nurse case manager for every confirmed or suspect TB case. The nurse case manager is responsible for ensuring that the TB patient receives the necessary services that will enable him/her to complete an appropriate and effective course of treatment, by initiating directly observed therapy or other appropriate measures, as needed. Nursing case management is required regardless of the source of health care (public or private) or the ability to pay for services and treatment. Nursing Case Management Protocols and case management fact sheets are available from the DTBPC by calling (617) 983-6970 during office hours. Assistance is also available from regional-based Tuberculosis Surveillance Area (TSA) nurses.

The nurse case manager is responsible for investigating every confirmed or clinically suspect case of TB that is reported to determine, if possible, the source of the patient's disease and the possible spread of infection to others. The initial case investigation is to be done by the LBOH nurse case manager within three working days after the LBOH is notified of the potential case and is optimally done in the hospital and/or patient's home environment, accompanied by an outreach educator, when indicated. (*Note: A laboratory report is not a diagnosis. LBOH should discuss any positive or negative findings on such reports with the attending physician before discussing them with a patient.*) The case investigation includes a nursing assessment to determine potential transmission of disease to others, the risk of infection for contacts based on level and duration of exposure, and the medical, environmental, economic, and social factors which may influence adherence to the prescribed treatment plan. A MDPH *TB History Form* (found at the end of this chapter) must be completed and sent to the DTBPC.

Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.



## Section 4:

# CONTROLLING FURTHER SPREAD

## A. Isolation and Quarantine Requirements (105 CMR 300.200)

Control measures are for infectious TB cases/suspects only. No control restrictions are applicable for LTBI or contacts of cases.

### *Minimum Period of Isolation for TB Cases/Suspects*

Pulmonary and laryngeal TB cases/suspects should be isolated until determined to be bacteriologically negative based on three consecutive negative sputum smears, submitted within a time period specified in the most current recommendations of the CDC, or until 14 days after the initiation of appropriate effective chemotherapy—provided therapy is continued as prescribed and there is demonstration of clinical improvement (e.g., decreasing cough, reduced fever, resolving lung infiltrates, or AFB smears showing decreasing numbers of organisms).

No restrictions are needed for extra-pulmonary TB case/suspects except for appropriate handling of infected fluids.

Regulations (*105 CMR 365.000*) are applicable in the community when a LBOH needs to make decisions about whether a patient with TB should return to community activities. In general, an infectious patient may remain in the home as long as there is no threat to the community or other vulnerable persons at risk for TB infection or disease. Questions regarding community isolation should be directed to the DTBPC at (617) 983-6970.

## **B. Protection of Contacts of Case**

MDPH regulation (*105 CMR 365.200 C*) provides the LBOH nurse case manager the legal authority to conduct contact investigations (CI) according to the CDC recommendations and to prepare CI reports in accordance with DTBPC policies. Infected contacts of an active case are at extremely high risk of developing disease, and their identification and appropriate management must be a priority.

The LBOH nurse must initiate the CI no more than three working days after the case/suspect is reported to the LBOH. Evaluation of identified contacts consists of a tuberculin skin test, using the Mantoux method, and when indicated, a referral for medical evaluation, including a chest radiograph to rule out active TB disease. Contacts with an initial negative skin test should be re-tested by the LBOH nurse 8–12 weeks after the contact's last exposure to the case while the case was infectious. The LBOH nurse must report the contacts' names and the results of their initial screening and medical evaluation to the respective regional TSA nurse on contact report forms provided by the DTBPC after each round of testing.

Comprehensive CI policies and procedures are available through the DTBPC at (617) 983-6970.

## **C. Managing Special Situations**

Contacts under five years of age and immunosuppressed contacts should be medically evaluated and considered for treatment, regardless of skin test result.

In situations involving contacts to MDR TB cases or public exposures from a TB case/suspect (e.g., schools, daycare centers, work site, health care facilities, shelter, correctional facilities), LBOH should seek assistance from the DTBPC TSA nurses.

## **D. Preventive Measures**

The DTBPC, in agreement with recommendations from the CDC, advises the LBOH to work with local providers and others serving high-risk populations to develop, implement, and evaluate LTBI screening programs in the community. The LBOH should tuberculin skin test high-risk individuals, and if found infected, refer them for a medical evaluation and possible treatment for LTBI to prevent activation of TB disease in the future. To prevent future TB cases, infected persons should begin and complete recommended treatment for LTBI. The DTBPC is available for consultation regarding methods for establishing priorities among high-risk populations in the community.

*Attachment A: State-funded Tuberculosis Clinics* contains a list of state-funded TB clinics where patients can receive specialized TB care at no cost. This list is also available on the MDPH website at [www.mass.gov/dph/cdc/tb/tbserv.htm](http://www.mass.gov/dph/cdc/tb/tbserv.htm).

A Treatment of Latent TB Infection Fact Sheet can be obtained from the CDC website at [www.cdc.gov/nchstp/tb](http://www.cdc.gov/nchstp/tb). Click on the “Education/Training Materials” link, and select the “Fact Sheets” link.

A Tuberculosis Disease Public Health Fact Sheet is available from the DTBPC or on the MDPH website at [www.mass.gov/dph](http://www.mass.gov/dph). Click on the “Publications and Statistics” link, and select the “Public Health Fact Sheets” section under “Communicable Disease Control.”



## ADDITIONAL INFORMATION

The following is the formal CDC surveillance case definition for TB. It is provided for your information only and should not affect the investigation and reporting of a case that fulfills the criteria in Section 2A of this chapter. (The CDC and the MDPH use the CDC case definitions to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

*Note: The most up-to-date CDC case definitions are available on the CDC website at [www.cdc.gov/epo/dphsi/casedef/case\\_definitions.htm](http://www.cdc.gov/epo/dphsi/casedef/case_definitions.htm).*

### Clinical Description

A chronic bacterial infection caused by *M. tuberculosis*, characterized pathologically by the formation of granulomas with or without tissue necrosis. The most common site of infection is the lung, but other organs may be involved.

### Laboratory Criteria for Diagnosis

- ◆ Isolation of *M. tuberculosis* from an appropriate respiratory tract clinical specimen;
- ◆ Demonstration of *M. tuberculosis* from a clinical specimen by nucleic acid amplification test; or
- ◆ Demonstration of AFB in a clinical specimen when a culture has not been or cannot be obtained.

### Clinical Case Definition

- ◆ A positive tuberculin skin test or other approved test for TB infection (e.g., Quanti-Feron Gold);
- ◆ Other signs and symptoms compatible with TB (e.g., an abnormal, unstable [i.e., worsening or improving] chest radiographs, or clinical evidence of current disease);
- ◆ Treatment with two or more anti-tuberculosis medications; or
- ◆ Completed diagnostic evaluation.

## Case Classification

**Confirmed**

A case that meets the clinical case definition or is laboratory-confirmed.



## REFERENCES

- American Thoracic Society and Centers for Disease Control and Prevention. Diagnostic Standards and Classification of Tuberculosis in Adults and Children. *Am J Crit Care Med.* 2000; 161: 1376–1395.
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- MDPH. Regulation *105 CMR 300.000: Reportable Diseases, Surveillance, and Isolation and Quarantine Requirements.* MDPH, Promulgated November 4, 2005.
- MDPH. Regulation *105 CMR 350.000: Determining Active Tuberculosis.* MDPH.
- MDPH. Regulation *105 CMR 365.200: Standards for Managing Tuberculosis Outside Hospitals: Case Management.* MDPH, Promulgated August 1994.
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<[www.mass.gov/dph/cdc/tb](http://www.mass.gov/dph/cdc/tb)>.
- MDPH DTBPC. “2004 Tuberculosis Overview.” Massachusetts Department of Public Health.  
<[www.mass.gov/dph/cdc/tb](http://www.mass.gov/dph/cdc/tb)>.

## Attachments

*Attachment A: State-Funded Tuberculosis Clinics*

# Attachment A:

## State-Funded Tuberculosis Clinics

Tuberculosis Clinics Metro-Boston	
Boston Medical Center, Boston Clerk	(617) 534-4967
Children's Hospital, Boston Pulmonary Services*	(617) 355-7881
Lemuel Shattuck Hospital, Boston (Out Patient Department)	(617) 971-3443
Cambridge Hospital, Cambridge Cambridge Clinic	(617) 665-1291 or (617) 665-3803
Lahey Clinic, Burlington Clinic Coordinator	(781) 744-8480

Tuberculosis Clinics Central	
Health Alliance, Burbank Campus (Fitchburg) Clinic Coordinator	(978) 466-4252
Harrington Memorial Hospital, Southbridge Harrington Home Care	(508) 765-1515
Family Health & Social Services (Worcester City Hospital) Worcester Clinic	(508) 860-7700

Tuberculosis Clinics Northeast	
Lawrence General Hospital, Lawrence Lawrence Health Dept.	(978) 794-5960
Saints Memorial Hospital, Lowell Lowell Health Dept.	(978) 446-1626
Hallmark Health/Malden Medical Ctr. Malden Health Dept. Everett Health Dept. Medford Health Dept. Melrose Health Dept.	(781) 397-7052 (617) 394-2314 (781) 393-2449 (781) 979-4130
North Shore Pulmonary PHC Salem Hospital	(978) 354-4455

Tuberculosis Clinics Western	
Baystate Medical Center, Springfield Clinic Coordinator	(413) 794-5435
Berkshire Medical Center, Pittsfield Berkshire Med. Ctr.	(413) 447-2654
Franklin Medical Center, Greenfield Cardio/ Pulmonary	(413) 773-2289

Tuberculosis Clinics Southeast	
Brockton Hospital, Brockton Brockton Health Dept.	(508) 584-1200
Cape Cod Hospital, Hyannis Clinic Coordinator	(508) 862-5369
Morton Hospital, Taunton Taunton Health Dept.	(508) 828-6733
St. Anne's Hospital, Fall River Fall River Health Dept.	(508) 324-2422
Sturdy Memorial Hospital, Attleboro Local Health Dept.	(508) 223-2222, x324

Updated June 2005



# **FORMS & WORKSHEETS**

*Tuberculosis*