
MICHIGAN
TUBERCULOSIS
PROGRAM MANUAL

Table of Contents

INTRODUCTION.....	1.1	SURVEILLANCE.....	2.1
About the Michigan Tuberculosis Program Manual	1.2	Introduction	2.2
Purpose.....	1.2	Purpose.....	2.2
Audience.....	1.2	Policy.....	2.5
How to Use This Manual	1.3	Laws and rules.....	2.5
Portable document format.....	1.3	Tuberculosis Classification System	2.6
Hyperlinks.....	1.3	Reporting Tuberculosis	2.7
Cross-references.....	1.3	Reporting suspected or confirmed cases of tuberculosis to the local public health agency.....	2.11
Forms.....	1.3	Required reports from local public health agencies to the Michigan Department of Community Health Tuberculosis Unit.....	2.15
Bookmarks.....	1.4	Data Collection.....	2.16
Printing.....	1.5	Michigan Disease Surveillance System	2.16
Icons.....	1.6	Document retention.....	2.16
Abbreviations.....	1.7	Genotyping	2.17
Purpose of Tuberculosis Control.....	1.10	Dissemination and Evaluation.....	2.19
Michigan Laws and Rules on Tuberculosis Control	1.11	References.....	2.20
Objectives and Standards	1.12	 	
Quality of care.....	1.12	TARGETED TESTING FOR LATENT TUBERCULOSIS INFECTION.....	3.1
National and state program objectives.....	1.13	Introduction	3.2
Standards.....	1.17	Purpose.....	3.2
Roles, Responsibilities, and Contact Information	1.19	Policy.....	3.2
State tuberculosis program staff.....	1.19	State Laws and Regulations.....	3.4
Tuberculosis consultants	1.20	Program Standards.....	3.6
Local public health agencies.....	1.20	When to Conduct Targeted Testing	3.9
Private medical providers.....	1.20	Approaches to increasing targeted testing and treatment for latent tuberculosis infection.....	3.9
Laboratories.....	1.21	Screening for latent tuberculosis infection in facilities.....	3.10
Resources and References	1.22	References.....	3.11

LABORATORY SERVICES... 4.1

Introduction.....4.2

 Purpose.....4.2

 Policy4.2

 Program Standards.....4.3

Available Laboratory Tests.....4.5

Specimen Collection4.7

 How to perform spontaneous sputum collection at a healthcare facility 4.8

 How to direct a patient to perform spontaneous sputum collection at home..... 4.9

 Induced sputum collection at a healthcare facility 4.10

 How to collect gastric aspirates 4.10

 Bronchoscopy or collection of extrapulmonary specimens 4.10

Specimen Shipment4.11

Resources and References4.13

DIAGNOSIS OF TUBERCULOSIS DISEASE... 5.1

Introduction.....5.2

 Purpose.....5.2

 Policy5.3

 Forms.....5.3

Case Finding5.4

 Identifying suspected tuberculosis cases..... 5.4

 Follow-up on suspected cases of tuberculosis 5.6

Diagnosis of Tuberculosis Disease... ..5.7

 Medical history 5.8

 Human immunodeficiency virus screening 5.11

 Physical examination 5.11

 Tuberculin skin test and interferon gamma release assays..... 5.1

 Chest radiography..... 5.13

 Bacteriologic examination 5.14

Resources and References5.17

TREATMENT OF TUBERCULOSIS DISEASE... 6.1

Introduction6.2

 Purpose..... 6.2

 Policy..... 6.2

Basic Treatment Principles.....6.3

Treatment Regimens and Dosages.....6.5

 Regimens 6.5

 Dosages 6.9

 Duration of treatment..... 6.13

Side Effects and Adverse Reactions6.15

 Basic monitoring steps 6.15

 Reporting reactions 6.17

 Monitoring for side effects and adverse reactions by antituberculosis drug..... 6.18

Response to Treatment.....6.25

Completion of Therapy.....6.26

Post-Treatment Evaluation6.27

Treatment in Special Situations6.28

 Drug-resistant tuberculosis..... 6.28

 Human immunodeficiency virus infection..... 6.29

 Alcoholism 6.30

 Liver disease 6.32

 Renal insufficiency and end-stage renal disease 6.32

 Tuberculosis associated with tumor necrosis factor-alpha antagonists 6.35

 Culture-negative pulmonary tuberculosis 6.36

 Extrapulmonary tuberculosis 6.36

 Pregnancy and breastfeeding 6.37

 Tuberculosis in children..... 6.38

Resources and References.....6.39

DIAGNOSIS OF
LATENT TUBERCULOSIS
INFECTION..... 7.1

Introduction.....7.2

 Purpose.....7.2

 Policy7.2

High-Risk Groups7.3

**Diagnosis of Latent
Tuberculosis Infection7.4**

 Interferon gamma release assays.....7.4

 Mantoux tuberculin skin testing7.5

 Candidates for Mantoux tuberculin
 skin testing.....7.6

 Administration of the tuberculin skin test7.9

 Measurement of the tuberculin skin test7.11

 Interpretation of the tuberculin skin test.....7.12

 Human immunodeficiency virus screening7.14

 Follow-up activities.....7.14

 Chest radiography.....7.14

Resources and References7.17

TREATMENT OF LATENT
TUBERCULOSIS
INFECTION..... 8.1

Introduction.....8.2

 Purpose.....8.2

 Policy8.3

Whom to Treat.....8.4

 Susceptible and vulnerable contacts8.4

 Tuberculin skin test results of 5 mm or more8.5

 Tuberculin skin test results of 10 mm or more.....8.6

 Tuberculin skin test results of 15 mm or more.....8.6

Treatment Regimens and Dosages.....8.7

 Regimens.....8.8

 Dosages.....8.9

**Side Effects and
Adverse Reactions8.10**

 Basic monitoring steps 8.10

 Reporting reactions 8.11

 Monitoring for side effects and adverse
 reactions by antituberculosis drug..... 8.13

Adherence8.16

 Monthly assessment of adherence..... 8.16

 Directly observed therapy..... 8.17

Completion of Therapy.....8.18

Treatment in Special Situations8.20

 Human immunodeficiency virus and
 latent tuberculosis infection..... 8.20

 Alcoholism 8.21

 Pregnancy and breastfeeding 8.21

Resources and References.....8.22

CASE MANAGEMENT..... 9.1

Introduction9.2

 Purpose..... 9.2

 Policy..... 9.3

 Forms 9.3

 Acknowledgments 9.4

Initial Assessment9.5

 Cultural sensitivity and language issues 9.5

 Patient's medical records 9.6

 Assessment site 9.6

 Discharge planning..... 9.6

 Initial assessment activities 9.6

Treatment Plan9.11

 Treatment plan components..... 9.12

 Planning activities..... 9.13

 Implementation activities 9.14

**Ongoing Assessment
and Monitoring9.16**

 Ongoing assessment activities 9.16

 Monitoring side effects and
 adverse reactions 9.20

Activities to monitor for side effects and adverse reactions.....	9.20
Monitoring bacteriologic improvement	9.21
Completion of Therapy	9.26
Verifying adequate course of treatment.....	9.26
Calculating completion of therapy.....	9.27
Closures other than completion of therapy	9.27
Evaluation.....	9.28
Evaluation activities	9.28
Directly Observed Therapy	9.30
Candidates for directly observed therapy	9.30
How to deliver directly observed therapy	9.31
Adherence to directly observed therapy	9.32
Incentives and Enablers	9.34
Legal Orders.....	9.35
Progressive interventions.....	9.35
Resources and References	9.38
PATIENT EDUCATION.....	10.1
Introduction.....	10.2
Purpose.....	10.2
Policy	10.3
State Laws and Regulations.....	10.3
Materials and Resources	10.3
General Guidelines	10.4
Language and Comprehension Barriers	10.5
Education Topics.....	10.6
Medical diagnosis	10.6
Contact investigation.....	10.7
Isolation.....	10.7
Side effects and adverse reactions.....	10.8
Adherence.....	10.8
Assessment for Patient Adherence or Difficulty.....	10.9
Patient Education Materials.....	10.14
Resources and References	10.15

CONTACT INVESTIGATION.....	11.1
Introduction	11.2
Purpose.....	11.2
Policy.....	11.3
State Laws and Regulations.....	11.4
Forms	11.4
Structure of a Contact Investigation	11.5
Basic steps of a contact investigation	11.5
Contact investigation plan	11.5
Decision to Initiate a Contact Investigation	11.6
Factors predicting transmission of tuberculosis	11.6
Deciding to initiate a contact investigation	11.9
Time Frames for Contact Investigation	11.12
Information about the index patient and transmission sites.....	11.12
Contact evaluation and treatment	11.14
Ongoing management activities.....	11.15
Infectious Period.....	11.17
Index Patient Interviews.....	11.19
Preinterview preparation	11.19
General guidelines for interviewing an index patient.....	11.20
Field Investigation	11.21
Contact Priorities.....	11.23
Index patient with positive acid-fast bacilli sputum smear results or cavitary tuberculosis.....	11.24
Index patient with negative acid-fast bacilli sputum smear results.....	11.25
Index patient with negative bacteriologic results and abnormal chest radiographs not consistent with tuberculosis.....	11.26
Contact Evaluation, Treatment, and Follow-up	11.27

Immunocompromised contacts and children under five.....	11.29
Immunocompetent adults and children five and older (high- and medium-priority contacts)	11.30
Contacts with prior positive tuberculin skin tests	11.31
When to Expand a Contact Investigation	11.33
Guidelines for expanding an investigation	11.33
Low-priority contacts	11.35
Data Management and Evaluation of Contact Investigations.....	11.36
Reasons contact investigation data are needed.....	11.36
Approach.....	11.37
Index patient and contact data.....	11.38
Evaluation of a contact investigation.....	11.40
Outbreak Investigation.....	11.42
Definition of a tuberculosis outbreak.....	11.42
Deoxyribonucleic acid genotyping	11.43
Resources and References	11.44
INFECTION CONTROL.....	12.1
Introduction.....	12.2
Purpose.....	12.2
Policy	12.3
State Laws and Regulations.....	12.3
Hierarchy of Infection Control Measures	12.4
Administrative controls.....	12.4
Environmental controls	12.6
Personal respiratory protection	12.7
Who Should Use a Mask or Respirator	12.10
Two-Step Tuberculin Skin Testing....	12.11
Isolation	12.13
Estimating infectiousness	12.14
Determining noninfectiousness.....	12.14

Airborne Infection Isolation in a Healthcare Facility	12.16
When to initiate airborne infection isolation.....	12.16
When to discontinue airborne infection isolation	12.17
Hospital Discharge	12.19
Drug-susceptible tuberculosis disease.....	12.19
Multidrug-resistant tuberculosis disease	12.20
Release settings.....	12.20
Residential Settings.....	12.21
Administrative controls in the patient's home..	12.21
Environmental controls in the patient's home..	12.22
Respiratory protection in the patient's home ...	12.22
Other residential settings.....	12.23
Return to Work, School, or Other Social Settings.....	12.24
Drug-susceptible tuberculosis disease.....	12.24
Multidrug-resistant tuberculosis disease	12.25
Tuberculosis Infection Control in Patient Care Facilities	12.26
Transportation Vehicles.....	12.28
Patient self-transport	12.28
Transport by healthcare workers.....	12.28
Transport by emergency medical services.....	12.28
Resources and References.....	12.29
INTERJURISDICTIONAL NOTIFICATIONS.....	13.1
Introduction	13.2
Purpose.....	13.2
Policy.....	13.3
When to Initiate a Notification	13.4
How to Issue a Notification	13.5
Transfers inside the United States	13.5
Sample Interjurisdictional TB Notification and Follow-Up Forms.....	13.6
Transfers outside the United States.....	13.8
References.....	13.10

B NOTIFICATIONS.....	14.1
Introduction.....	14.2
Purpose.....	14.2
Pre-arrival medical screening for tuberculosis..	14.2
Policy	14.5
Follow-up of B1 and B2 Tuberculosis Arrivals.....	14.6
Division of Global Migration and Quarantine forms and Overview of Notification Process for Newly-Arrived Individuals	14.6
Patient follow-up.....	14.7
The TB Follow-Up Worksheet.....	14.8
Completion of the TB Follow-Up Worksheet...14.10	
Evaluation of B1 and B2 Tuberculosis Arrivals.....	14.14
Evaluation Activities	14.14
Treatment.....	14.14
Resources and References	14.16

Introduction

CONTENTS

About the Michigan Tuberculosis Program Manual	1.2
Purpose.....	1.2
Audience	1.2
How to Use This Manual	1.3
Portable document format.....	1.3
Hyperlinks	1.3
Cross-references	1.3
Forms.....	1.3
Bookmarks.....	1.4
Printing.....	1.5
Icons	1.6
Abbreviations	1.7
Purpose of Tuberculosis Control.....	1.10
Michigan Laws and Rules on Tuberculosis Control	1.11
Objectives and Standards	1.12
Quality of care.....	1.12
National and state program objectives.....	1.13
Standards.....	1.17
Roles, Responsibilities, and Contact Information	1.19
State tuberculosis program staff	1.19
Tuberculosis consultants	1.20
Local public health agencies.....	1.20
Private medical providers.....	1.20
Laboratories	1.21
Resources and References	1.22

About the Michigan Tuberculosis Program Manual

Purpose

This manual is designed to present the key steps and crucial information needed to perform tuberculosis (TB) control tasks in states in which TB occurs with a low incidence—defined by the Centers for Disease Control and Prevention (CDC) as less than 3.5 cases/100,000 population/year.¹ Where additional or more detailed information is available, hyperlinks to CDC guidelines and other resources are provided.

The *Michigan Tuberculosis Program Manual* is based on a template created by an advisory group convened during CDC Task Order #6. The advisory group developed the template's format and created its content by reviewing other TB control manuals, current CDC guidelines, and needs in the four low-incidence states of Idaho, Montana, Utah, and Wyoming.

Audience

The audience for this manual includes local public health nurses, outreach workers, physicians, and public health officers; Indian Health Services (IHS) staff; physician consultants; private sector physicians; infection control nurses in hospitals and other facilities; disease intervention specialists; state epidemiologists; and state TB program staff.

How to Use This Manual

Portable Document Format

This manual is available electronically as a portable document format (PDF) file. To view the PDF file, you will need the free Adobe Reader, available at this hyperlink: <http://www.adobe.com/products/acrobat/readstep2.html> .

Hyperlinks

When viewing this manual online with an Internet connection, you can go directly to underlined Web addresses by clicking on them.

Cross-References

When viewing this manual electronically, you can go directly to other sections or topics in the manual by clicking on text next to this icon:



Forms

Required and recommended forms are available on the Michigan Department of Community Health TB website at www.michigan.gov/tb or at the Michigan Advisory Committee on the Elimination of Tuberculosis website at www.michigantb.org. This icon alerts you that forms are available:



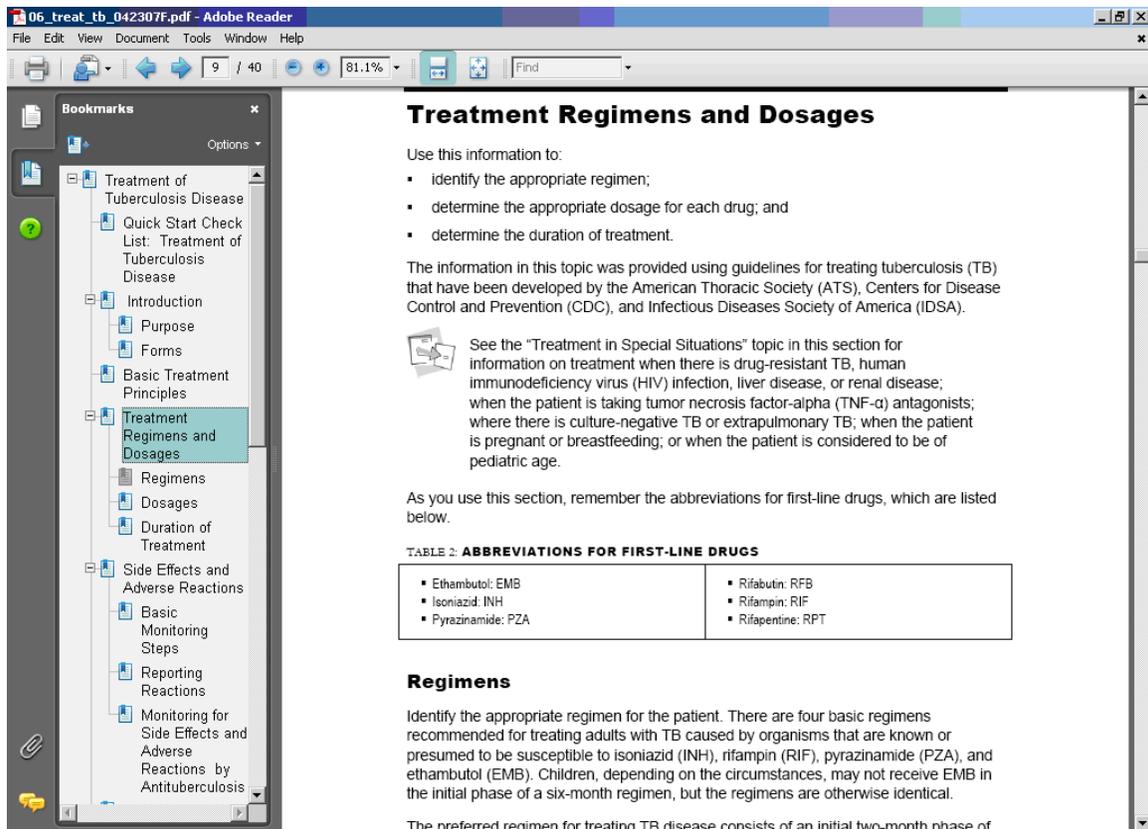
Bookmarks

In PDF files, you can use bookmarks to go quickly to a section or topic. If the bookmarks are not visible on the left, click the Bookmarks icon or tab on the left of the window.

To view sections and topics in the bookmarks list:

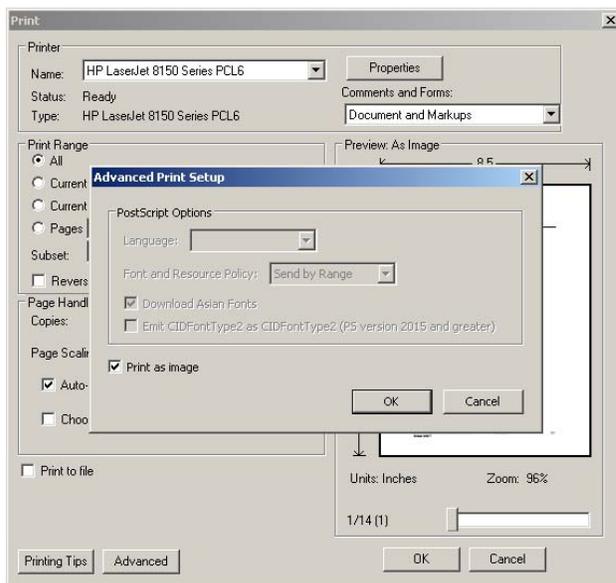
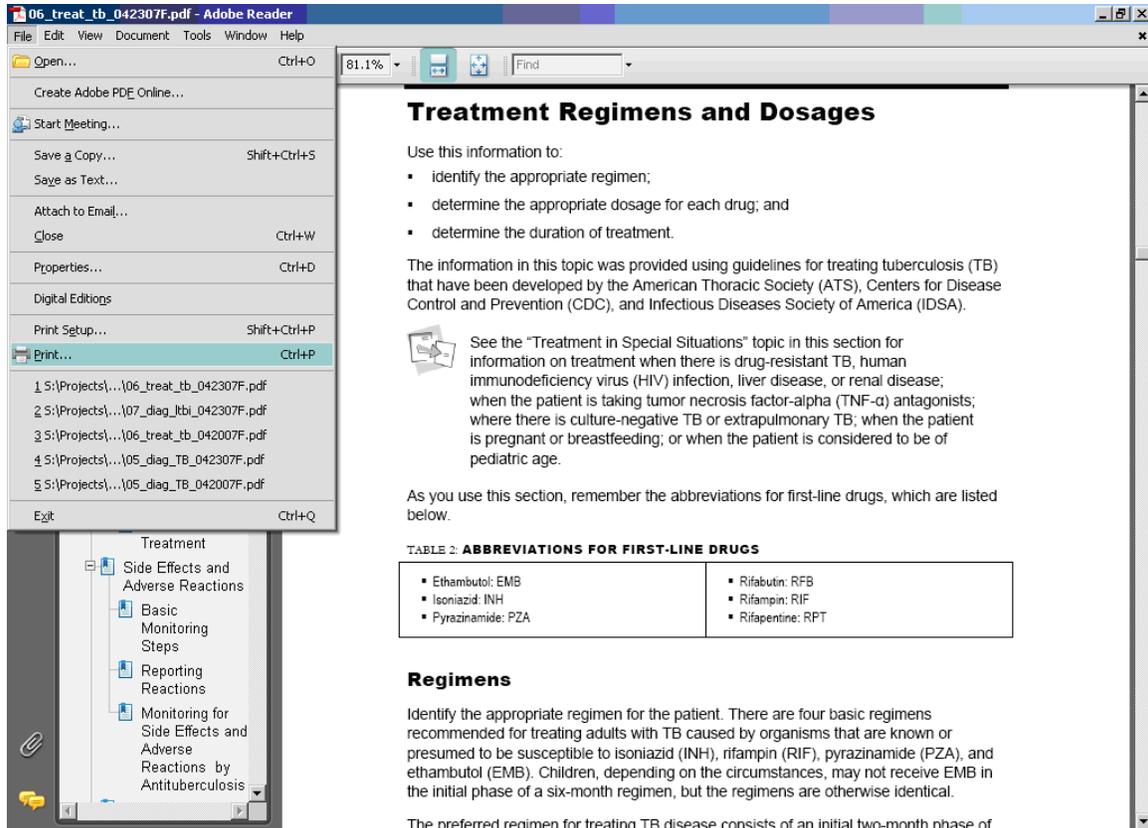
- Click + to see a more detailed list.
- Click – to hide the more detailed list.

To go to a section or topic in the bookmarks list, point to its name and left-click.



Printing

To access the print dialog box, click the File drop-down menu, click Print, and then make your selections in the Print dialog box.



Some printers have older printer drivers that cause spaces to appear in the middle of words. To avoid this problem, select File/Print, click the Advanced button, check Print as Image, and then click OK. If you need further assistance with printing, call the Francis J. Curry National Tuberculosis Center's IT staff at 415-502-5810.

Icons

Throughout the manual, these icons quickly cue you into important information and other resources:



This warns about high-consequence information you must understand when performing the task.



This signals when you should call to report or to consult on the task.



This highlights special considerations for pediatric patients.



This suggests another relevant area in the manual or another resource that you may want to review.



This alerts you that a form is available for the task.

Abbreviations

Refer to the list below for abbreviations used in the manual.

ACET	Advisory Council for the Elimination of Tuberculosis
ACH	air changes per hour
AFB	acid-fast bacilli
AIDS	acquired immunodeficiency syndrome
All	airborne infection isolation
ALT	alanine aminotransferase
ARPE	Aggregate Report for Program Evaluation
ART	antiretroviral therapy
AST	aspartate aminotransferase
ATS	American Thoracic Society
BAMT	blood assay for <i>Mycobacterium tuberculosis</i>
BCG	bacille Calmette-Guérin
CDC	Centers for Disease Control and Prevention
CT	computed tomography
CXR	chest radiograph
DNA	deoxyribonucleic acid
DOT	directly observed therapy
DTBE	Division of Tuberculosis Elimination
DTH	delayed-type hypersensitivity
ED	emergency department
EMB	ethambutol
EMS	emergency medical service
ESRD	end-stage renal disease

FDA	U.S. Food and Drug Administration
HAART	highly active antiretroviral therapy
HCW	healthcare worker
HEPA	high-efficiency particulate air
HIPAA	Health Insurance Portability and Accountability Act
HIV	human immunodeficiency virus
IDSA	Infectious Diseases Society of America
IGRA	interferon gamma release assay
INH	isoniazid
LTBI	latent tuberculosis infection
<i>M. tuberculosis</i>	<i>Mycobacterium tuberculosis</i>
MDCH	Michigan Department of Community Health
MDR-TB	multidrug-resistant tuberculosis
MDSS	Michigan Disease Surveillance System
MIACET	Michigan Advisory Committee for Elimination of Tuberculosis
MIRU	mycobacterial interspersed repetitive units
MOTT	mycobacterium other than tuberculosis
NAA	nucleic acid amplification
NIOSH	National Institute for Occupational Safety and Health
NNRTI	nonnucleoside reverse transcriptase inhibitors
NTCA	National Tuberculosis Controllers Association
NTM	nontuberculous mycobacteria
NTNC	National Tuberculosis Nurse Coalition
OSHA	Occupational Safety and Health Administration
PAPR	powered air-purifying respirator
PCR	polymerase chain reaction
PI	protease inhibitor

PPD	purified protein derivative
PZA	pyrazinamide
QA	quality assurance
QFT	QuantiFERON [®] -TB test
QFT-G	QuantiFERON [®] -TB Gold test
RFB	rifabutin
RFLP	restriction fragment length polymorphism
RIF	rifampin
RNA	ribonucleic acid
RPT	rifapentine
RVCT	Report of Verified Case of Tuberculosis
RZ	rifampin and pyrazinamide
TB	tuberculosis
TIMS	Tuberculosis Information Management System
TNF- α	tumor necrosis factor-alpha
TST	tuberculin skin test
TU	tuberculin units
USCIS	U.S. Citizenship and Immigration Services
UVGI	ultraviolet germicidal irradiation
XDR-TB	extensively drug-resistant tuberculosis

Purpose of Tuberculosis Control

Tuberculosis (TB) is a bacterial disease caused by *Mycobacterium tuberculosis*. (These organisms are sometimes called tubercle bacilli.) Mycobacteria can cause a variety of diseases. Some mycobacteria are called tuberculous mycobacteria because they cause TB or diseases similar to TB. These include *M. tuberculosis*, *M. bovis*, and *M. africanum*. Other mycobacteria are called nontuberculous mycobacteria (NTM) because they do not cause TB-like disease. One common type of nontuberculous mycobacteria is *M. avium* complex. Tuberculous mycobacteria readily spread from person to person; nontuberculous mycobacteria do not usually spread from person to person.

The goal of TB control in the United States is to reduce TB morbidity and mortality by doing the following:

- Preventing transmission of *M. tuberculosis* from persons with contagious forms of the disease to uninfected persons
- Preventing progression from latent TB infection (LTBI) to active TB disease among persons who have contracted *M. tuberculosis* infection²



For information on the transmission of *M. tuberculosis* and on how LTBI progresses to TB disease, see the Centers for Disease Control and Prevention's (CDC's) online course, *Interactive Core Curriculum on Tuberculosis* (2004), at this hyperlink:

<http://www.cdc.gov/tb/webcourses/corecurr/index.htm> .

The four fundamental strategies to reduce TB morbidity and mortality include the following:

1. Early and accurate detection, diagnosis, and reporting of TB cases, leading to initiation and completion of treatment
2. Identification of contacts of patients with infectious TB and treatment of those at risk with an effective drug regimen
3. Identification of other persons with latent TB infection at risk for progression to TB disease and treatment of those persons with an effective drug regimen
4. Identification of settings in which a high risk exists for transmission of *M. tuberculosis* and application of effective infection control measures³



For more information on these strategies and the thinking behind them, see "Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America" (*MMWR* 2005;54[No. RR-12]) at this hyperlink:

<http://www.cdc.gov/MMWR/PDF/rr/rr5412.pdf> .

Michigan Laws and Rules on Tuberculosis Control

Michigan laws and rules on tuberculosis (TB) are located on the Michigan Legislature Website <http://www.legislature.mi.gov>



The powers and duties of local health departments relating to tuberculosis control are covered in Sections 333.2451, 333.5117, 333.5203, 333.5205, 333.5207 and 333.5301 of the Michigan Compiled Laws. Requirements for reporting suspected or confirmed cases of tuberculosis are described in 325.171 through 325.173 of the MDCH Communicable Disease Rules.



Contact the Michigan TB Program at (517) 335-8165 for assistance with interpreting laws and rules regarding TB control.

Objectives and Standards

Quality of Care

For tuberculosis (TB) programs, quality of care is measured by objectives and standards. Such objectives and standards are used as yardsticks to direct the program and measure its success.

Objectives reflect outcomes or results and program desires. Programs require objectives to define expected outcomes and results for case management activities.

Standards are an accepted set of conditions or behaviors that define what is expected and acceptable regarding job duties, performance, and provision of services. The TB control program works to achieve objectives through a series of standards.

In Michigan, TB program objectives and standards are established from the following:

State Laws and Regulations

The Michigan Public Health Code describes the powers and duties of local health departments in controlling tuberculosis within their jurisdiction. The Michigan Department of Community Health Communicable Disease rules describe requirements for reporting suspected and confirmed cases of tuberculosis to local and state health departments.

TB Program Agreements, Plans, and Protocols

The Centers for Disease Control and Prevention (CDC) has awarded a cooperative agreement for tuberculosis prevention and control to the Michigan Department of Community Health. The terms of this cooperative agreement indicate program objectives and performance targets that each recipient is expected to achieve (see Table 1 below). These objectives and targets form the core of the MDCH TB Control Program's goals and objectives for TB control activities in Michigan.

National TB Guidelines

Guidelines for the treatment of latent TB infection (LTBI) and tuberculosis disease have been published by the following entities.

- American Thoracic Society (ATS)
- Infectious Diseases Society of America (IDSA)
- CDC Division of Tuberculosis Elimination (DTBE) guidelines

National and State Program Objectives

Below are national and state TB program objectives. The CDC program objectives were announced in February, 2009, and are effective for the cooperative agreement period of 2010 – 2015. All objectives are targeted to be achieved by 2015 unless noted otherwise. Under each national objective, there is a state objective established by the Michigan TB Program, based on Michigan’s epidemiology and recent program performance.

Table 1: PROGRAM OBJECTIVES AND PERFORMANCE TARGETS, 2010 - 2015

Indicator		National Tuberculosis Program Objectives and Performance Targets
1	Percent completion of treatment	<p>Increase timely completion of treatment</p> <p>National Objective: At least 93% of patients with newly diagnosed tuberculosis (TB), for whom therapy for 12 months or less is indicated, will complete treatment within 12 months.</p>
2	TB case rate	<p>Decline in TB rates</p> <p>a. National Objective: The average yearly decline in TB rates in the US born will be $\geq 11\%$.</p> <p>b. National Objective: The average yearly decline in TB rates in the foreign born will be $\geq 4\%$.</p> <p>c. National Objective: The TB rate in U.S. born will be < 0.7 cases/100,000.</p> <p>d. National Objective: The TB rate in foreign born will be < 14 cases/100,000.</p> <p>e. National Objective: The TB rate in U.S.-born black non-Hispanics will be < 1.3 cases/100,000.</p> <p>f. National Objective: The TB rate in children < 5 years of age will be < 0.4/100,000.</p>

Indicator		National Tuberculosis Program Objectives and Performance Targets
3	Thorough contact investigations	<p>Improve contact identification, evaluation, and treatment</p> <ul style="list-style-type: none"> a. National Objective: All sputum-AFB-smear-positive TB cases will have at least one contact identified. b. National Objective: At least 93% of contacts to sputum-AFB-smear-positive TB cases will be evaluated for infection and disease. c. National Objective: At least 88% of infected contacts will start treatment. d. National Objective: At least 79% of contacts who start treatment will complete treatment.
4	Timely laboratory reporting	<p>Ensure timely laboratory reporting</p> <ul style="list-style-type: none"> a. National Objective: These objectives were in review at the time this manual was assembled. Current objectives (2005 – 2009) are that culture identification of <i>M. tuberculosis</i> complex should be reported to submitter and state TB program within 21 days of receipt. b. National Objective: Increase the proportion of culture-positive TB cases with initial drug-susceptibility results reported to 100%.
5	Treatment Initiation	<p>Ensure timely initiation of treatment</p> <p>National Objective: This national objective is currently under revision. MIACET and the MDCH TB Control Program recommend that all TB patients with positive AFB sputum-smear results should initiate appropriate multi-drug therapy within 7 days of sputum smear result or diagnosis, unless a diagnosis or suspicion of TB can be solidly refuted.</p>

Indicator		National Tuberculosis Program Objectives and Performance Targets
6	Sputum Culture Conversion	<p>Ensure timely conversion of sputum culture status</p> <p>National Objective: Increase the proportion of patients with positive sputum culture results who have documented conversion to sputum culture-negative within 60 days of treatment initiation to 61.5%.</p>
7	Data Reporting	<p>Increase completeness of reporting on core data variables</p> <p>a. National Objective: Increase the completeness of each core Report of Verified Case of Tuberculosis (RVCT) variable reported to CDC to 99.2%.</p> <p>b. National Objective: Increase the completeness of each core Aggregate Report of Program Evaluation (ARPE) variable reported to CDC to 100% in the final report period. (Final ARPE reports are due 2 years after the calendar year in which the case was reported).</p> <p>c. National Objective: Increase the completeness of each core Electronic Disease Notification (EDN) system variable reported to CDC to n%. This objective is still being revised by CDC, but MIACET and the MDCH TB Control Program recommend that all variables be completed and reported to CDC for persons entering the U.S. with a class A or B status for tuberculosis.</p>
8	Recommended Initial Therapy	<p>Increase proportion of patients receiving recommended antituberculosis therapy.</p> <p>National Objective: Increase the proportion of patients who are started on the recommended initial 4-drug regimen when suspected of having TB disease to 93.4%.</p>

Indicator		National Tuberculosis Program Objectives and Performance Targets
9	Universal Genotyping	<p>Increase the proportion of culture-confirmed cases with a genotyping result reported.</p> <p>National Objective: Increase the proportion of culture-confirmed TB cases with a genotyping result reported to 94%.</p>
10	Known HIV Status	<p>Increase the proportion of TB cases with a known HIV status reported</p> <p>National Objective: Increase the proportion of TB cases with positive or negative HIV test result reported to 88.7%.</p>
11	Evaluation of Immigrants and Refugees	<p>For immigrants and refugees with overseas chest x-rays interpreted as consistent with TB, increase the proportion that are evaluated and treated.</p> <p>National objectives for the following indicators are currently being revised by CDC. MIACET and the MDCH TB Control Program recommend the following performance targets.</p> <ul style="list-style-type: none"> a. For immigrants and refugees with overseas chest x-rays interpreted as consistent with TB, increase the proportion who initiate medical evaluation within 30 days of arrival to 90%. b. For immigrants and refugees with overseas chest x-rays interpreted as consistent with TB, increase the proportion who complete medical evaluation within 90 days to 100%. c. For immigrants and refugees with overseas chest x-rays interpreted as consistent with TB and who are diagnosed with LTBI during evaluation in the U.S., increase the proportion who start LTBI treatment to 80%. d. For immigrants and refugees with overseas chest x-rays interpreted as consistent with TB and who are diagnosed with LTBI during evaluation in the U.S., increase the proportion who complete LTBI treatment to 75%.

Indicator		National Tuberculosis Program Objectives and Performance Targets
12	Sputum-Culture Reported	<p>Increase the proportion of TB cases with pleural or respiratory disease that have sputum culture result reported.</p> <p>National Objective: Increase the proportion of TB cases with a pleural or respiratory site of disease in patients 12 years of age or older that have sputum-culture result reported to 95.7%.</p>

Source: National TB Program Objectives and Performance Targets for 2015. Atlanta, GA: CDC Division of Tuberculosis Elimination; January, 2009.

Standards

Program standards are what the stakeholders of the TB program would consider to be "reasonable expectations" for the program. For TB, standards have been established by nationally accepted authorities, such as the American Thoracic Society (ATS), the Infectious Diseases Society of America (IDSA), and the CDC, and generally recognized TB control experts, such as the National Tuberculosis Nurse Coalition (NTNC) and the National Tuberculosis Controllers Association (NTCA). Many state programs, and some local TB control programs, have established their own standards and objectives for case management.

The standards of care for the medical treatment and control of TB are published jointly by ATS, IDSA, and the CDC. These standards should be available for reference by each TB staff member. The standards are included in the following guidelines:

- ATS, CDC, IDSA. "Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America" (*MMWR* 2005;54[No. RR-12]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5412.pdf> .
- ATS, CDC, IDSA. "Diagnostic Standards and Classification of Tuberculosis in Adults and Children" (*Am J Respir Crit Care Med* 2000;161[4 Pt 1]). Available at: <http://www.thoracic.org/sections/publications/statements/pages/archive/tbadult1-20.html> .
- ATS, CDC, IDSA. "Treatment of Tuberculosis" (*MMWR* 2003;52[No. RR-11]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf> .
- CDC, NTCA. "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis: Recommendations from the National Tuberculosis Controllers

Association and CDC” (*MMWR* 2005;54 [No. RR-15]). Available at:
<http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf> .

- CDC. “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005” (*MMWR* 2005;54[No. RR-17]). Available at:
<http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .
- CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]). Available at:
<http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf> .

For additional guidelines, see the Division of Tuberculosis Elimination’s “TB Guidelines” Web page (Division of Tuberculosis Elimination Web site; accessed November 25, 2006). Available at: <http://www.cdc.gov/tb/publications/guidelines/default.htm> .

Roles, Responsibilities, and Contact Information

State Tuberculosis Program Staff

Table 2: STATE TUBERCULOSIS PROGRAM STAFF ROLES, RESPONSIBILITIES, AND CONTACT INFORMATION

Roles and Responsibilities	Contact Information
Michigan TB Program Coordinator	<p>Peter Davidson, PhD Michigan Department of Community Health Capital View Building 201 Townsend Street Lansing, MI 48913 Phone: 517-335-8165 Email: davidsonp@michigan.gov</p>
CDC Senior Public Health Advisor- TB Control Liaison	<p>Vern Green, MSPH Michigan Department of Community Health Capital View Building 201 Townsend Street Lansing, MI 48913 Phone: 517-335-8165 Email: green1@michigan.gov</p>
TB Epidemiologist	<p>Noreen Mollon, MS Michigan Department of Community Health Capital View Building 201 Townsend Street Lansing, MI 48913 Phone: 517-335-8165 Email: mollonn@michigan.gov</p>
TB Nurse Consultant	<p>Patty Raines, RN, MSN Michigan Department of Community Health Capital View Building 201 Townsend Street Lansing, MI 48913 Phone: 517-335-8165 Email: rainsp@michigan.gov</p>
TB Nursing Specialist	<p>Katie Dotson, RN, BSN Michigan Department of Community Health Capital View Building 201 Townsend Street Lansing, MI 48913 Phone: 517-335-8165 Email: dotsonk1@michigan.gov</p>

Tuberculosis Consultants

Table 3: TUBERCULOSIS CONSULTANTS' ROLES, RESPONSIBILITIES, AND CONTACT INFORMATION

Roles and Responsibilities	Contact Information
TB Clinical Consultant	James Sunstrum, MD Oakwood TB Clinic Westland, MI (734) 727-1130
City of Detroit TB Clinical Consultant	Dana Kissner, MD Division of Pulmonary, Critical Care, and Sleep Medicine Harper University Hospital 3990 John R Detroit, MI 48201 313-745-0895

Local Public Health Agencies

Table 4: LOCAL PUBLIC HEALTH AGENCIES' ROLES, RESPONSIBILITIES, AND DIRECTORY

Roles and Responsibilities	Contact Information
In Michigan, the local health departments are responsible for tuberculosis prevention and control for their jurisdiction. Many provide primary case management of LTBI and TB cases.	http://malph.org/page.cfm/18/

Private Medical Providers

Table 5: ROLES AND RESPONSIBILITIES OF PRIVATE MEDICAL PROVIDERS FOR TUBERCULOSIS DIAGNOSIS AND TREATMENT

Roles and Responsibilities
Private providers can diagnose and treat persons with TB and LTBI, but they are required to report suspect or confirmed cases as specified in the MDCH Communicable Disease Rules. Local health departments bear ultimate responsibility in assuring appropriate treatment and case management for patients with TB disease, and providers should therefore consult frequently with their local health department when managing a case of suspected or confirmed TB disease.

Laboratories

The MDCH Bureau of Laboratories provides full-extent TB laboratory testing. For detailed information regarding laboratory testing and services available, refer to the Laboratory Services chapter, or contact the MDCH Bureau of Laboratories, mycobacteriology unit, at 517-335-9637 or 517-335-9636.

Resources and References

Resources

- CDC. "Framework for Program Evaluation in Public Health" (*MMWR* 1999;48[No. RR-11]). Available at: <ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4811.pdf> .
- Division of Tuberculosis Elimination. *A Guide to Developing a TB Program Evaluation Plan* (Division of Tuberculosis Elimination Web site; accessed November 1, 2006). Available at: <http://www.cdc.gov/TB/programs/Evaluation/guide.htm> .
- Division of Tuberculosis Elimination. *Understanding the TB Cohort Review Process: Instruction Guide* (Division of Tuberculosis Elimination Web site; accessed November 1, 2006). Available at: <http://www.cdc.gov/TB/education/cohort.htm> .
- New Jersey Medical School National Tuberculosis Center. *Planning & Implementing the TB Case Management Conference: A Unique Opportunity for Networking, Peer Support and Ongoing Training* (Newark, NJ; 2004). Available at: <http://www.umdnj.edu/globaltb/products/planning&implementing.htm> .

References

-
- ¹ CDC. Progressing toward tuberculosis elimination in low-incidence areas of the United States: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR* 2005;51(No. RR-5):1.
 - ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):14.
 - ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.

Surveillance

CONTENTS

Introduction.....	2.2
Purpose.....	2.2
Policy	2.5
Laws and rules.....	2.5
Tuberculosis Classification System	2.6
Reporting Tuberculosis	2.7
Reporting suspected or confirmed cases of tuberculosis to the local public health agency.....	2.11
Required reports from local public health agencies to the Michigan Department of Community Health Tuberculosis Unit.....	2.15
Data Collection.....	2.16
Michigan Disease Surveillance System.....	2.16
Document retention.....	2.16
Genotyping.....	2.17
Dissemination and Evaluation	2.19
References	2.20

Introduction

Purpose

Use this section to do the following:

- Understand the importance of surveillance in tuberculosis (TB) control and prevention.
- Report suspected and confirmed TB cases.
- Ensure you are using the required data collection forms.
- Understand how the computerized TB registry works.
- Understand how genotyping can assist TB control efforts.

Surveillance—the ongoing systematic collection, analysis, interpretation, and dissemination of data about a health-related event—is a critical component of successful TB control, providing essential information needed to do the following:

1. Determine TB patterns and trends of the disease.
2. Identify sentinel events, such as potential outbreaks, recent transmission, multidrug resistance, and deaths.
3. Identify high-risk populations and settings.
4. Establish priorities for control and prevention activities.
5. Strategically plan use of limited resources.¹

Surveillance data are also essential for quality-assurance purposes, program evaluation, and measurement of progress toward TB elimination.

State and local TB control programs should have the capability to monitor trends in TB disease and latent TB infection (LTBI) in populations at high risk, in order to detect new patterns of disease and possible outbreaks. Populations at high risk should be identified and targeted for active surveillance and prevention, including targeted testing and treatment of LTBI. The following populations have been demonstrated to be at risk for TB exposure, progression from exposure to disease, or both: children, foreign-born persons, human immunodeficiency virus (HIV)-infected persons, homeless persons, and detainees and prisoners. Surveillance and surveys from throughout the United States indicate that certain epidemiologic patterns of TB are consistently observed among these populations, suggesting that the recommended control measures are generalizable. State and local surveillance data should be analyzed to determine additional high-risk population groups.

In addition to providing the epidemiologic profile of TB in a given jurisdiction, state and local surveillance are essential to national TB surveillance.² Data for the national TB surveillance system are reported by state health departments in accordance with standard TB case definition and case report formats. The case report that the Michigan Department of Community Health utilizes is found in the Michigan Disease Surveillance System. The data collected in this system follows the Federal standard case report format. The Centers for Disease Control and Prevention's (CDC's) national TB surveillance system publishes epidemiologic analyses of reported TB cases in the United States.³

Reporting of new cases is essential for surveillance purposes.⁴

Surveillance in TB Control Activities

Case detection: Case reporting to the jurisdictional public health agency is done for surveillance purposes and for facilitating a treatment plan and case management services.⁵



For more information on case reporting, see the “Reporting Tuberculosis” topic in this section.

Outbreak detection: Surveillance data should be routinely reviewed to determine if there is an increase in the expected number of TB cases, one of the criteria for determining if an outbreak is occurring. For an increase in the expected number of TB cases to be identified, the local epidemiology of TB should be understood. Detection of a TB outbreak in an area in which prevalence is low might depend on a combination of factors, including recognition of sentinel events, routine genotype cluster analysis of surveillance data, and analysis of *Mycobacterium tuberculosis* drug resistance and genotyping patterns.⁶ Genotyping data should routinely be reviewed because genotype clusters also may indicate an outbreak. Prompt identification of potential outbreaks and rapid responses are necessary to limit further TB transmission. When an outbreak is identified, short-term investigation activities should follow the same principles as those for the epidemiologic part of the contact investigation (i.e., identifying the infectious period, settings, risk groups, and mode of transmission and conducting contact identification and follow-up). However, long-term activities require continued active surveillance.



For more information on outbreak investigations, see the “Outbreak Investigation” topic in the Contact Investigation section.

Contact investigation: Collecting, analyzing, interpreting, and disseminating data on contacts and contact investigations are necessary for prioritizing the highest-risk contacts to focus the use of resources, in accordance with national guidelines. Although surveillance of individual contacts to TB cases is not conducted in the United States, the CDC collects aggregate data from state and local TB programs through the *Aggregate*

Report for Program Evaluation (ARPE). Routine collection and review of this data can provide the basis for evaluation of contact investigations for TB control programs.⁷



For more information on surveillance in contact investigations, see the Contact Investigation section.

Targeted testing: Review and interpretation of surveillance data inform targeted testing policies and strategies. Targeted testing is intended to identify persons other than TB contacts who have an increased risk for acquiring TB and to offer such persons diagnostic testing for *M. tuberculosis* infection and treatment, if indicated, in order to prevent subsequent progression to TB disease. Targeted testing and treatment of LTBI are best accomplished through cost-effective programs aimed at patients and populations identified on the basis of local surveillance data as being at increased risk for TB.⁸



For more information on surveillance and targeted testing, see the Targeted Testing section.

Treatment of LTBI: Surveillance of persons with LTBI does not routinely occur in the United States. However, the CDC is developing a national surveillance system to record adverse events leading to the hospitalization or death of a person under treatment for LTBI. Healthcare providers are encouraged to report such events to the CDC's Division of Tuberculosis Elimination by calling 1-404-639-8401. Surveillance of these events will provide data to evaluate the safety of treatment regimens recommended in current guidelines.⁹



For more information on surveillance and targeted testing, see the Targeted Testing section. For more information on updated LTBI treatment recommendations, see the CDC's "Update: Adverse Event Data and Revised American Thoracic Society/CDC Recommendations Against the Use of Rifampin and Pyrazinamide for Treatment of Latent Tuberculosis Infection—United States, 2003" (*MMWR* 2003;52[31];735–739) at this hyperlink: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.

Policy

Data collection and reporting on TB should be done in accordance with Michigan Public Health Code and Communicable Disease Rules. Reporting and recordkeeping requirements are covered in this section.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.



For more information on confidentiality and the Health Insurance Portability and Accountability Act (HIPAA), see the Confidentiality section.

Laws and Rules

Michigan regulations on tuberculosis (TB) can be found in the Health Care Professionals Guide to the Michigan Communicable Disease Rules.



See “Communicable and Related Diseases Rules” and “Health Care Professionals Guide to the Michigan Communicable Disease Rules” at http://www.michigan.gov/mdch/0,1607,7-132-2945_5104_53072_53074---.00.html.



Contact the MDCH TB Unit at 517-335-8165 for assistance with interpreting state laws and rules regarding TB control.

Tuberculosis Classification System

The system for classifying tuberculosis (TB) is based on how the infection and disease develop in the body. Use this classification system to help track the status of TB in your patients and to allow comparison with other reporting areas.

Table 1: TUBERCULOSIS CLASSIFICATION SYSTEM¹⁰

Class	Type	Description
0	<ul style="list-style-type: none"> ▪ No tuberculosis (TB) exposure ▪ Not infected 	<ul style="list-style-type: none"> ▪ No history of exposure ▪ Negative reaction to the tuberculin skin test (TST) or interferon gamma release assay (IGRA)
1	<ul style="list-style-type: none"> ▪ TB exposure ▪ No evidence of infection 	<ul style="list-style-type: none"> ▪ History of exposure ▪ Negative reaction to the TST or IGRA
2	<ul style="list-style-type: none"> ▪ TB infection ▪ No disease 	<ul style="list-style-type: none"> ▪ Positive reaction to the TST or IGRA ▪ Negative bacteriologic studies (if done) ▪ No clinical, bacteriologic, or radiographic evidence of TB disease
3	<ul style="list-style-type: none"> ▪ TB disease ▪ Clinically active 	<ul style="list-style-type: none"> ▪ <i>Mycobacterium tuberculosis</i> complex cultured (if this has been done) ▪ Clinical, bacteriologic, or radiographic evidence of current disease
4	<ul style="list-style-type: none"> ▪ TB disease ▪ Not clinically active 	<ul style="list-style-type: none"> ▪ History of episode(s) of TB <li style="text-align: center;">Or ▪ Abnormal but stable radiographic findings ▪ Positive reaction to the TST or IGRA ▪ Negative bacteriologic studies (if done) <li style="text-align: center;">And ▪ No clinical or radiographic evidence of current disease
5	<ul style="list-style-type: none"> ▪ TB suspect 	<ul style="list-style-type: none"> ▪ Diagnosis pending

Source: Adapted from: CDC. Classification system. In: Chapter 2: transmission and pathogenesis. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.

Reporting Tuberculosis

Detecting and reporting suspected cases of tuberculosis (TB) is the key step in stopping transmission of *Mycobacterium tuberculosis* because it leads to prompt initiation of effective multiple-drug treatment, which rapidly reduces infectiousness. The Centers for Disease Control and Prevention (CDC) reports that delays in reporting cases of pulmonary TB are one of the major challenges to successful control of TB.¹¹ As one of the strategies to achieve the goal of reduction of TB morbidity and mortality, the CDC recommends immediate reporting of a suspected or confirmed case of TB to the jurisdictional health agency.¹² Also, by Michigan law and regulation, a case of TB disease must be reported to the local public health agency.

When reporting TB, keep the following definitions in mind:

- **Case:** An episode of TB disease in a person meeting the laboratory or clinical criteria for TB, as defined in the document “Case Definitions for Infectious Conditions Under Public Health Surveillance.”¹³ These criteria are listed below in Table 2.¹⁴
- **Suspect:** A person for whom there is a high index of suspicion for active TB (e.g., a known contact to an active TB case or a person with signs or symptoms consistent with TB) who is currently under evaluation for TB disease.¹⁵
- **Confirmed:** A case that meets the clinical case definition or is laboratory confirmed, as described below in Table 2.¹⁶

Table 2: CASE DEFINITIONS¹⁷

Clinical Case Definition	Laboratory Criteria for Diagnosis
<p>A clinical case meets all of the following criteria:</p> <ul style="list-style-type: none"> ▪ A positive tuberculin skin test ▪ Other signs and symptoms compatible with tuberculosis (e.g., an abnormal, unstable [i.e., worsening or improving] chest radiograph, or clinical evidence of current disease) ▪ Treatment with 2 or more antituberculosis medications ▪ Completed diagnostic evaluation 	<p>A case is laboratory confirmed when it meets one of the following criteria:</p> <ul style="list-style-type: none"> ▪ Isolation of <i>Mycobacterium tuberculosis</i> from a clinical specimen* ▪ Demonstration of <i>M. tuberculosis</i> from a clinical specimen by nucleic acid amplification (NAA) test† ▪ Demonstration of acid-fast bacilli (AFB) in a clinical specimen when a culture has not been or cannot be obtained
<p>* Use of rapid identification techniques for <i>M. tuberculosis</i> (e.g., deoxyribonucleic acid [DNA] probes and mycolic acids high-pressure liquid chromatography performed on a culture from a clinical specimen) is acceptable under this criterion.</p> <p>† NAA tests must be accompanied by culture for mycobacteria species. However, for surveillance purposes, the CDC will accept results obtained from NAA tests approved by the Food and Drug Administration and used according to the approved product labeling on the package insert.</p>	

Source: Adapted from: CDC. Case definitions for infectious conditions under public health surveillance. *MMWR* 1997;46(No. RR-10):40–41.

Suspect pulmonary TB and initiate a diagnostic investigation when the historic features, signs, symptoms, and radiographic findings of TB are evident among adults. TB should be suspected in any patient who has a persistent cough for over two to three weeks, or other indicative signs and symptoms.¹⁸



For more information on suspected pulmonary TB, see the Diagnosis of Tuberculosis Disease section.

Mandatory and timely case reporting from community sources (e.g., providers, laboratories, hospitals, and pharmacies) should be enforced and evaluated regularly. Reporting enables the TB control program to take action at local, state, and national levels and to understand the magnitude and distribution of the TB problem.¹⁹

Prompt reporting (prior to culture confirmation) allows the state and local public health agency to do the following quickly:

- Verify diagnosis.
- Assign a case manager and coordinate treatment.
- Determine if an outbreak is occurring.
- Control the spread of TB.²⁰

Failure to report cases threatens public health because it may result in the adverse outcome of a patient's treatment or delayed contact investigation of an infectious case.²¹

Reporting gives physicians access to resources provided by the local health department. Private physicians are strongly encouraged to work collaboratively with their local health department in the management of their TB cases and contacts. All providers who undertake evaluation and treatment of patients with TB must recognize that, not only are they delivering care to an individual, they are assuming a critical public health function that entails a high level of responsibility to the community, as well as to the individual patient. The following public health services are available to assist physicians in managing their TB cases:

- Epidemiologic investigation, including identification and examination of contacts
- Chest radiographic services
- Antituberculosis medications
- Extensive laboratory testing at State Of Michigan Bureau of Laboratories (MDCH BOL)
- Referral for clinical consultation

Local health departments and private providers are strongly encouraged to submit all clinical specimens to MDCH BOL for analysis.

State Laws and Regulations

Reporting of Suspect and Confirmed Cases (Communicable Disease Rules: R 325.171-173)

Michigan Communicable Disease Rules require reporting of suspect and confirmed cases of *M. tuberculosis Complex* within 24 hours of diagnosis or discovery to the appropriate local health department. "Appropriate" is defined as the local health department that has jurisdiction where an individual who has a disease or condition that is required to be reported resides, or the local health department of the county in which the service facility is located.

Submission of Clinical Specimens (Michigan Communicable Disease Rules: R325.179)

Rule 9. (1) For the purpose of this rule, "preliminary result" includes, but is not limited to, results from nucleic acid amplification tests, nucleic acid or other genetic probe tests, chromatographic or other such tests that may be performed prior to final culture identification of a clinical specimen. (2) A laboratory that initially receives any clinical specimen which yields *Mycobacterium tuberculosis complex*, or yields a preliminary result indicative of *Mycobacterium tuberculosis complex*, is responsible for ensuring that the following are submitted: (a) All preliminary results and any interpretation of those results to the appropriate local health department. (b) The first *Mycobacterium tuberculosis complex* isolate, or subculture thereof, from the patient being tested for tuberculosis, to the department. (c) Any *Mycobacterium tuberculosis complex* isolate, or subculture thereof, from a follow-up specimen, collected 90 days or more after the collection of the first *Mycobacterium tuberculosis complex* positive specimen.



For more information on confidentiality and the Health Insurance Portability and Accountability Act (HIPAA), see the Confidentiality section.

Reporting Suspected or Confirmed Cases of Tuberculosis to the Local Public Health Agency

Healthcare providers and laboratories should report suspected or confirmed cases of TB using the information in Table 3.

Table 3: WHEN TO REPORT TUBERCULOSIS

What Condition/ Test Result	Who Reports	When to Report	How to Report
<p>Confirmed or suspected cases of tuberculosis (TB) disease</p> <p>Confirmation by laboratory tests is not required.</p> <p>This includes pulmonary and extrapulmonary cases.</p>	<ul style="list-style-type: none"> ▪ Physicians ▪ Other healthcare providers ▪ Hospitals ▪ Other similar private or public institutions ▪ Anyone providing treatment to the confirmed or suspected case <p>Note: The attending physician or other healthcare provider must report even if the laboratory is also reporting the test results.</p>	<p>Report to your local health department within 24 hours of diagnosis or discovery.</p>	<p>Telephone</p> <p>Please contact your local health department. Telephone numbers can be found at the link provided above.</p> <p>Fax</p> <p>Please contact your local health department. Fax numbers can be found at the link provided above.</p> <p>Online</p> <p>If you have access to the Michigan Disease Surveillance System, please fill out the appropriate information by selecting reportable condition: Tuberculosis to report suspected and confirmed cases of TB.</p>

What Condition/ Test Result	Who Reports	When to Report	How to Report
<p>Cultures growing AFB or cultures that are demonstrated positive for <i>Mycobacterium tuberculosis</i> complex*</p> <p>Nucleic acid amplification tests/DNA probes positive for <i>M. tuberculosis</i> complex</p>	<p>All laboratories that perform TB testing</p> <p>In-state laboratories that send specimens for out-of-state testing</p> <p>Note: The laboratory must report even if the attending physician or other healthcare provider is also reporting.</p>	<p>Report finding to your local health department within 24 hours.</p> <p>Submit Isolates demonstrated positive for <i>Mycobacterium tuberculosis</i> complex to MDCH BOL as soon as possible. Preferably within 24 hours of identification.</p>	
<p>* Note: This includes both the preliminary report of cultures growing AFB without confirmation of <i>M. tuberculosis</i> complex and the final report of cultures that are demonstrated to be positive for <i>M. tuberculosis</i> complex.</p>			



If you have access to the Michigan Disease Surveillance System (MDSS), please fill out the appropriate information by selecting reportable condition: Tuberculosis. If you do not have access to the MDSS, please contact your local health department to report the case.

Healthcare Providers

Healthcare providers should report the following information on confirmed or suspected cases of TB.

Reporting Healthcare Provider

- Name
- Address
- Phone number
- Date of report

Patient Information

- Name
- Address
- Phone numbers
- Marital status
- Employment information
- Hospital admission information (name of hospital if applicable, date of admission)
- Type of isolation arrangements (if applicable, home, hospital, other)
- Parent/Guardian Name if patient under 18

Demographic and Social Information

- Date of birth
- Sex
- Race/ethnic origin
- Country of birth/date of arrival in the United States
- Injecting and Non-Injecting Drug and alcohol use

(Demographic and Social Information)

- Homeless within past year?
- Diagnosed in a correctional facility or long-term care facility?

Medical Information

- Reason for test
- Symptoms/onset
- Disease site
- Comorbid health conditions
- Human immunodeficiency virus (HIV) testing information
- Results of QuantiFERON[®]-TB Gold (QFT-G) or tuberculin skin test (TST) (TST in mm) and date of test
- Chest radiograph results and dates (if applicable)
- Bacteriology results, date(s), and name of laboratory performing test(s)
- Drug therapy (medications used, dates given, mode of treatment)

Laboratories

Laboratories should report the following information on test results.

Reporting Laboratory

- Name
- Address
- Phone number
- Date of report

Sputum Smears Positive for Acid-Fast Bacilli (AFB)

- Date of Collection
- Result and Number of AFBs if available

Cultures Growing AFB or Cultures Positive for *Mycobacterium tuberculosis*

- Date of Collection
- Sample type
- Result

Nucleic acid amplification tests/DNA probes positive for *M. tuberculosis* complex

- Date of Collection
- Sample type
- Result

Required Reports from Local Public Health Agencies to the MDCH Tuberculosis Unit

Local public health agencies are required to complete the Tuberculosis information in the MDSS.

Please refer to the document "[MDSS: Suspect/Active Tuberculosis Case Reporting Guide](#)" for information on how to report TB cases.

Data Collection

Michigan Disease Surveillance System (MDSS)

To carry out mandatory community public health responsibilities, the MDCH TB control program maintains a computerized record and reporting system (MDSS) with up-to-date information on all current clinically active and suspected TB cases in the state. The TB case registry should ensure that laboratory data, including all initial diagnostic tests, are promptly reported, if applicable, to the healthcare provider and local and state TB control programs. Follow-up tests, including data on sputum culture conversion and drug susceptibility testing of clinical isolates, should also be promptly reported so any needed modifications in management can be made.

The MDSS contains all information that is reported in the Report of Verified/Suspect Case of Tuberculosis.

Document Retention

The MDCH TB Program will maintain all state TB public health records for 30 years.

TB case records since 1989 are available at the state TB Program office.

All other records will be stored off-site and will require a minimum of 24 hours for retrieval.

Radiographs are not stored by MDCH. Radiographs are held by the principal healthcare provider or radiology office where the radiographs were obtained.

Case management health information and other TB records should be maintained at the local public health agency according to local record retention rules and regulations.

Genotyping

Genotyping is a useful tool for studying the pathogenesis, epidemiology, and transmission of *Mycobacterium tuberculosis*. *M. tuberculosis* genotyping refers to laboratory procedures developed to identify *M. tuberculosis* isolates that are identical in specific parts of the genome (of similar strain types).

Genotyping is based on an analysis of deoxyribonucleic acid (DNA). Mycobacteria reproduce by binary fission, which means that in almost all cases each new bacillus has identical DNA, just as human identical twins are genetically identical to each other. However, changes in the DNA occur spontaneously at low frequency. Over time, these changes, known as DNA mutations, have accumulated to produce the diversity of *M. tuberculosis* strains currently circulating in the world.

The diversity of strain provides a means to identify instances of recent transmission of tuberculosis (TB) as well as the chains of transmission that occur among persons with TB. This diversity also helps to elucidate the patterns and dynamics of TB transmission. When a person with TB improves but then becomes ill again, this diversity can differentiate reactivation with the same strain of *M. tuberculosis* from reinfection with a different strain. Genotyping can also be used to identify false-positive cultures.

Advances in DNA analytic methods have made it possible for TB programs to obtain rapid and reliable genotyping results. These advances include the following:

- The determination of the complete DNA sequence of *M. tuberculosis* in 1998
- The development of IS6110-based restriction fragment length polymorphism (RFLP) genotyping, which provided a discriminatory typing method and led to a standardized system for genotyping *M. tuberculosis* isolates

Two new methods, spoligotyping and mycobacterial interspersed repetitive units (MIRU) analysis, are based on polymerase chain reaction (PCR) and provide much more rapid results than RFLP analysis. The addition of genotype information to the pool of information generated by surveillance data and data collected through epidemiologic investigation allow confirmation of suspected transmission. A potential outbreak should be suspected whenever there is more than one case of TB whose isolate has the same genotype (genotype cluster). Further investigation that includes review of surveillance data, chart review, and reinterview of TB cases may refute or confirm the epidemiologic connection between more than one TB case. In some instances, a genotype cluster reflects a false-positive culture that may be a result of laboratory cross-contamination. Routine review of genotyping data, along with epidemiologic, clinical, and laboratory data, may identify patients who are wrongly classified as TB patients and should be further investigated.

In order to identify TB patients who have matching TB strains and therefore may be in the same chain of transmission, the MDCH laboratory identifies the genotype of every culture positive TB isolate. The two methods they use for this procedure are spoligotyping and mycobacterial interspersed repetitive units (MIRU). When two or more

TB isolates have matching genotype patterns, the MDCH TB Program assigns a Cluster Identification Number and sends a notification to the local jurisdictions from which the cases were reported. These notifications are sent on a monthly basis. If you have any questions, please contact the MDCH TB Epidemiologist at (517) 335-8165.



For more information on genotyping, see the National Tuberculosis Controllers Association/Centers for Disease Control and Prevention Advisory Group on Tuberculosis Genotyping's *Guide to the Application of Genotyping to Tuberculosis Prevention and Control* available at: <http://www.cdc.gov/tb/publications/guidestoolkits/default.htm>.



All positive *M. tuberculosis* cultures should be sent to MDCH BOL.

Dissemination and Evaluation

Dissemination

Tuberculosis (TB) surveillance data should be disseminated periodically to healthcare providers, health agencies, and the public through multiple channels including health alerts, reports, summaries, and presentations.

Evaluation

The purpose of evaluating public health surveillance systems is to ensure that problems of public health importance are being monitored efficiently and effectively. TB surveillance systems should be evaluated periodically, and the evaluation should include recommendations for improving quality, efficiency, and usefulness. Evaluation of a public health surveillance system focuses on how well the system operates to meet its purpose and objectives.



For more information see the CDC's "Updated Guidelines for Evaluating Public Health Surveillance Systems" (*MMWR* 2001;50[No RR-13]) at: http://www.cdc.gov/mmwr/indrr_2001.html.

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):10. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):10.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):10.
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):5.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):39.
- ⁷ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):39.
- ⁸ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ⁹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):42.
- ¹⁰ CDC. "Classification system." Chapter 2: transmission and pathogenesis. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ¹¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):3.
- ¹² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ¹³ CDC. Case definitions for infectious conditions under public health surveillance. *MMWR* 1997;46(No. RR-10):40–41. Available at: http://www.cdc.gov/mmwr/preview/ind1997_rr.html.
- ¹⁴ CDC. *Reported Tuberculosis in the United States, 2004*. Atlanta, GA: US Department of Health and Human Services, CDC; September 2005. Appendix B, Section V.
- ¹⁵ CDC. *Reported Tuberculosis in the United States, 2004*. Atlanta, GA: US Department of Health and Human Services, CDC; September 2005. Appendix B, Section V.
- ¹⁶ CDC. Case definitions for infectious conditions under public health surveillance. *MMWR* 1997;46(No. RR-10):40–41.
- ¹⁷ CDC. Case definitions for infectious conditions under public health surveillance. *MMWR* 1997;46(No. RR-10):40–41.
- ¹⁸ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ¹⁹ ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161:1392. Available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- ²⁰ County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition* [County of Los Angeles Public Health Web site]. 2003:8–6. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf>.
- ²¹ County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition* [County of Los Angeles Public Health Web site]. 2003:8–7. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf>.

Targeted Testing for Latent Tuberculosis Infection

CONTENTS

Introduction.....	3.2
Purpose.....	3.2
Policy	3.2
When to Conduct Targeted Testing.....	3.4
Approaches to increasing targeted testing and treatment for latent tuberculosis infection	3.4
Screening for latent tuberculosis infection in facilities	3.5
References	3.6

Introduction

Purpose

Use this section to understand and follow national and Michigan guidelines to conduct targeted testing to screen for latent tuberculosis infection (LTBI).

In the 2005 guideline “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention (CDC), and the Infectious Diseases Society of America,” one of the recommended strategies to achieve the goal of reduction of tuberculosis (TB) morbidity and mortality is to identify persons with LTBI who are at risk for progression to TB disease and to treat them with an effective drug regimen.¹



For information on treatment, refer to the Treatment of Tuberculosis Disease and Treatment of Latent Tuberculosis Infection sections.

Reducing LTBI in high-risk populations is an important strategy to control TB. Considering that there are an estimated 9.5–14.7 million persons with LTBI in the United States, continued progress toward eliminating TB in the United States and reducing TB among foreign-born persons requires effective strategies to meet this challenge.² Targeted testing for LTBI is a strategic component of TB control that identifies persons who are at high risk for developing TB and who would benefit by treatment of LTBI, if detected. Persons with increased risk for developing TB include those who have had recent infection with *Mycobacterium tuberculosis* and those who have clinical conditions that are associated with an increased risk for progression of LTBI to active TB.³

Policy

In Michigan:

- Persons who show or report signs and symptoms of TB should be evaluated for TB disease as described in the Diagnosis of Tuberculosis Disease section and reported as suspected cases of TB as described in the “Reporting Tuberculosis” topic in the Surveillance section.
- Contacts should be evaluated as described in the Contact Investigation section.
- Targeted testing for LTBI should be conducted only among persons in groups with identified risk factors for LTBI and/or progression to TB disease.
- For a list of groups at high risk, refer to the “High-Risk Groups” topic in the section on Diagnosis of Latent Tuberculosis Infection.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

PUBLIC HEALTH CODE (EXCERPT) Act 368 of 1978

333.5111 Rules.

Sec. 5111.

(1) In carrying out its authority under this article, the department may promulgate rules to:

- (a) Designate and classify communicable, serious communicable, chronic, other noncommunicable diseases, infections, and disabilities.
- (b) Establish requirements for reporting and other surveillance methods for measuring the occurrence of diseases, infections, and disabilities and the potential for epidemics. Rules promulgated under this subdivision may require a licensed health professional or health facility to submit to the department or a local health department, on a form provided by the department, a report of the occurrence of a communicable disease, serious communicable disease or infection, or disability. The rules promulgated under this subdivision may require a report to be submitted to the department not more than 24 hours after a licensed health professional or health facility determines that an individual has a serious communicable disease or infection.
- (c) Investigate cases, epidemics, and unusual occurrences of diseases, infections, and situations with a potential for causing diseases.
- (d) Establish procedures for control of diseases and infections, including, but not limited to, immunization and environmental controls.
- (e) Establish procedures for the prevention, detection, and treatment of disabilities and rehabilitation of individuals suffering from disabilities or disease, including nutritional problems.
- (f) Establish procedures for control of rabies and the disposition of nonhuman agents carrying disease, including rabid animals.
- (g) Establish procedures for the reporting of known or suspected cases of lead poisoning or undue lead body burden.
- (h) Designate communicable diseases or serious communicable diseases or infections for which local health departments are required to furnish care including, but not limited to, tuberculosis and venereal disease.
- (i) Implement this part and parts 52 and 53 including, but not limited to, rules for the discovery, care, and reporting of an individual having or suspected of having a

communicable disease or a serious communicable disease or infection, and to establish approved tests under section 5125 and approved prophylaxes under section 5127.

(2) The department shall promulgate rules to provide for the confidentiality of reports, records, and data pertaining to testing, care, treatment, reporting, and research associated with communicable diseases and serious communicable diseases or infections. The rules shall specify the communicable diseases and serious communicable diseases or infections covered under the rules and shall include, but are not limited to, hepatitis B, venereal disease, and tuberculosis. The rules shall not apply to the serious communicable diseases or infections of HIV infection, or acquired immunodeficiency syndrome. The department shall submit the rules for public hearing under the administrative procedures act of 1969 by November 20, 1989.

History: 1978, Act 368, Eff. Sept. 30, 1978 ;-- Am. 1988, Act 491, Eff. Mar. 30, 1989 ;-- Am. 1989, Act 174, Imd. Eff. Aug. 22, 1989 ;-- Am. 1994, Act 200, Imd. Eff. June 21, 1994

Popular Name: Act 368

Admin Rule: R 325.60 and R 325.171 et seq. of the Michigan Administrative Code.

333.5117 Individual with serious communicable disease or infection; order authorizing care; report; authority not restricted; financial liability for care.

Sec. 5117.

(1) A local health department that knows that an individual who has a serious communicable disease or infection including, but not limited to, tuberculosis or venereal disease, but not including HIV infection and acquired immunodeficiency syndrome, regardless of the individual's domicile, is in the local health department's jurisdiction and requires care, immediately shall furnish the necessary care in accordance with requirements established by the department pursuant to section 5111(h). The local health department shall issue an order authorizing the care.

(2) The local health department promptly shall report the action taken under this section to the county department of social services of the individual's probable place of domicile.

(3) This section does not restrict the authority of the local health department in furnishing care to the individual, pending determination by the local health department or, upon its request, by the county department of social services of the probable place of domicile of the individual.

(4) Financial liability for care rendered under this section shall be determined in accordance with part 53.

History: Add. 1988, Act 491, Eff. Mar. 30, 1989 ;-- Am. 1994, Act 200, Imd. Eff. June 21, 1994

Popular Name: Act 368

Program Standards

Taken from Recommendations of the Michigan Advisory Committee for the Elimination of Tuberculosis (MI-ACET) March 2003. Michigan's Key Recommendations:

- A positive TB skin test result in Michigan shall be based on the Centers for Disease Control and Prevention (CDC) guidelines.
- International students, temporary professional workers, vocational workers, international adoptees and other persons arriving from countries with a high burden of TB disease, shall be tested for Latent TB Infection (LTBI).
- Health care professionals who administer and read tuberculin skin tests (TST), shall achieve certification through the TB skin test training course as identified by MDCH.
- MDCH will collaborate with the Michigan Department of Energy, Labor and Economic Growth (MDELEG) and other agencies in establishing rules for skin testing in special populations.
- Physicians, laboratories, and other health care professionals will report all cases of active and suspected TB as required by Michigan's Public Health Code.
- Directly Observed Therapy (DOT) is the standard of care for the management of all active cases of TB and selected high-risk individuals with LTBI.
- Testing for Human Immunodeficiency Virus (HIV) shall be performed on all active cases of TB.
- Accredited laboratories in the State of Michigan will comply with MDCH laboratory recommendations for TB specimen submission and testing.
- Local public health departments will utilize their authority in investigations and mandates for treatment or evaluation for TB as listed in the Public Health Code (Act 368, P.A. 1978, as amended, Section 333.5201-5207 of the Michigan Compiled Laws).
- Local public health departments shall follow MDCH recommendations regarding the U.S. Public Health Service notification system for identifying and evaluating immigrants and refugees who may be at risk for LTBI or TB disease.
- Employers whose workers are at greater risk for exposure to TB than the general population (health care facilities, correctional institutions, long-term care facilities, homeless shelters, and drug-treatment centers) shall comply with the Michigan Occupational Safety and Health Administration (MIOSHA) directives.

Targeted TB Skin Testing for LTBI

Targeted testing for TB is done to identify persons at high risk for TB disease who would benefit from treatment for latent TB infection (LTBI). Clinicians should give a TST to high-risk persons as part of their routine evaluation. QuantiFERON® TB Gold, a new blood test for identification of LTBI has recently been approved by the Food and Drug Administration (FDA). Recommendations for its use in select high-risk populations have been established by the CDC. Institutional testing is recommended for the staff of health care facilities, correctional facilities, as well as for the staff and residents of long-term care institutions where TB is found. TB testing programs for high-risk groups should be based on local epidemiology in consultation with MDCH. In Michigan, the proportion of foreign-born TB cases is increasing. A key MI-ACET recommendation is that foreign-born persons who come to the United States with a non-resident visa status, (international students, temporary professional workers, and vocational workers) shall receive testing for LTBI upon arrival at their Michigan location as a condition for participation in the program for which they are sponsored.

Guidelines for using the QuantiFERON®-TB Gold Test for Diagnosing LTBI

<http://www.cdc.gov/tb/publications/guidelines/Testing.htm>

Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection - MMWR 2000; 49 (No. RR-6)

<http://www.cdc.gov/tb/publications/guidelines/Testing.htm>

Screening for Tuberculosis and Tuberculosis Infection in High-Risk Populations (ACET) - MMWR 1995; 44 (No. RR-11)

http://www.cdc.gov/mmwr/preview/ind1995_rr.html

MI-ACET recommends TST certification. The Mantoux TST will be applied and read by designated staff that have received training and achieved certification by completion of the TST Workshop. This training includes, but is not limited to: how to apply a TST using 5 tuberculin units of purified protein derivative (PPD), how to read a TST, how to interpret a TST result, and supervised training in application and measuring of the skin test results. For more information on TST certification, contact the MDCH TB Program at (517) 335-8165. Michigan health care providers will follow the CDC guidelines for definition of a positive skin test result, and no longer use the measurement of ≥ 10 mm as a positive without risk factors. The following will be considered positive in Michigan as of this publication:

≥ 5 mm is classified as positive in:

HIV-positive persons

Recent contacts of a TB case

Persons with fibrotic changes on chest x-ray consistent with old healed TB

Patients with organ transplants and other immunosuppressed patients

≥ 10 mm is classified as positive in:

Recent arrivals from high-prevalence countries

Injection drug users

Residents and employees of high risk congregate settings

Mycobacteriology laboratory personnel

Persons with clinical conditions that place them at high risk
Children < 4 years of age, or children and adolescents exposed to adults in high-risk categories.

≥15 mm is classified as positive in persons with no known risk factors for TB

TST information can be found at in Chapter 3 of the Interactive Core Curriculum on Tuberculosis:

http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm

The MDLEG requires that certain groups be screened as a condition of employment. These requirements are listed in appendix D. MIOSHA also has requirements (GISHD-COM-05-2R2) for testing as part of a TB control program in health care settings, drug treatment centers, homeless shelters, and correctional facilities.

http://www.dleg.state.mi.us/wsh/docs/inst/gishd_com_05_2r2.doc

When to Conduct Targeted Testing

Targeted testing programs should be conducted only among groups at high risk, and testing should be discouraged for groups at low risk.⁴ High-risk groups include persons with increased risk for developing tuberculosis (TB) and those who have clinical conditions that are associated with an increased risk for the progression of latent TB infection (LTBI) to TB disease.



For a summary of the TB classification numbers, refer to the “Tuberculosis Classification System” topic in the Surveillance section.



Factors that identify persons at high risk of LTBI infection and/or of progression to TB disease are listed in the “High-Risk Groups” topic in the section on Diagnosis of Latent Tuberculosis Infection.



Evaluate high-risk patients for LTBI as specified in the Diagnosis of Latent Tuberculosis Infection section.



Offer treatment of LTBI to infected persons, irrespective of age, who are considered to be at high risk for developing active TB.⁵ See the Treatment of Latent Tuberculosis Infection section.

Approaches to Increasing Targeted Testing and Treatment of Latent Tuberculosis Infection

The Centers for Disease Control and Prevention (CDC) describes two approaches to increasing targeted testing and treatment of LTBI. To plan and implement programs for targeted testing and treatment of LTBI, follow the recommended approaches outlined below.⁶

One approach is to promote clinic-based testing of persons who are under a clinician’s care for a medical condition (e.g., human immunodeficiency virus [HIV] infection or diabetes mellitus) that also confers a risk for acquiring TB. This approach depends on a person’s risk profile for TB.⁷

The other approach is to establish specific programs that target a subpopulation of persons who have a high prevalence of LTBI or who are at high risk for acquiring TB disease if they have LTBI, or both. This approach requires identifying the subpopulations or areas with high TB risk through epidemiologic analysis and profiling.⁸



For information on the system for prioritizing persons for targeted testing, refer to “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America” (*MMWR* 2005;54[No. RR-12]:40–42) at http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.



For assistance in planning targeted testing, contact the TB Program Michigan Department of Community Health at (517) 335-8165.

Screening for Latent Tuberculosis Infection in Facilities

Screening for LTBI should be conducted based upon each facility’s risk for transmission of *Mycobacterium tuberculosis* (i.e., low risk, medium risk, or potential for ongoing transmission),⁹ as determined in its TB risk assessment (both the initial baseline assessment and periodic reassessments).



Risk assessment protocols and elements are outlined in the CDC’s “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005” (*MMWR* 2005;54[No. RR-17]) at <http://www.cdc.gov/tb/publications/guidelines/infectioncontrol.htm>.



In Michigan, facilities such as inpatient settings, outpatient settings, TB clinics, settings in correctional facilities in which health care is delivered, settings in which home-based health-care and emergency medical services are provided, and laboratories handling clinical specimens that might contain *M. tuberculosis* should follow these Occupational Safety and Health Administration (OSHA) and/or state requirements at: http://www.dleg.state.mi.us/wsh/docs/inst/gishd_com_05_2r2.doc

Screening determines if a person should be evaluated for LTBI or TB disease by asking questions to gather information about whether the person has signs or symptoms of TB disease, belongs to a group at high risk for LTBI or (if infected) for progression to TB disease, or has a prior positive tuberculin skin test (TST).

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):40.
- ³ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):1. Available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- ⁴ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):1–2.
- ⁵ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):1.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):40.
- ⁷ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):40.
- ⁸ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):40.
- ⁹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):10. Available at: <http://www.cdc.gov/tb/publications/guidelines/infectioncontrol.htm>.

Laboratory Services

CONTENTS

Introduction.....	4.2
Purpose.....	4.2
Policy	4.2
Program Standards.....	4.3
Available Laboratory Tests.....	4.5
Specimen Collection	4.7
How to perform spontaneous sputum collection at a healthcare facility	4.8
How to direct a patient to perform spontaneous sputum collection at home.....	4.9
Induced sputum collection at a healthcare facility	4.10
How to collect gastric aspirates	4.10
Bronchoscopy or collection of extrapulmonary specimens	4.10
Specimen Shipment	4.11
Resources and References	4.13

Introduction

Purpose

Use this section to do the following:

- Obtain contact information for laboratories.
- Determine which tests are available and the tests' turnaround times.
- Identify which laboratory can perform a specific test.

The diagnosis of tuberculosis (TB), management of patients with the disease, and public health TB control services rely on accurate laboratory tests. Laboratory services are an essential component of effective TB control, providing key information to clinicians (for patient care) and public health agencies (for control services).¹

Policy

Public health laboratories should ensure that clinicians and public health agencies within their jurisdictions have ready access to reliable laboratory tests for diagnosis and treatment of TB.²

Effective TB control requires timely, complete, and accurate communication among the laboratory system, TB control program, and healthcare provider.

Program Standards

RECOMMENDED NATIONAL STANDARDS FOR AFB LABORATORY TESTING

- *Rapid delivery of specimens to the laboratory (Delivery in lab within 24 hours from specimen collection)*
- *Use fluorescent acid-fast staining and microscopic examination (Report AFB slide result within 24 hours from receipt of specimen in lab)*
- *Use rapid broth system for primary culture detection of AFB (Report culture detection of AFB within 14 days)*
- *Use rapid ID, i.e. HPLC/genetic probes (Report TB ID within 14-21 days from receipt of specimen in lab)*
- *Use rapid broth susceptibility testing (Report susceptibility to primary anti-TB drugs within 21-28 days from receipt of specimen in lab)*
- *Report susceptibility results to attending physician as soon as available, i.e. by phone or FAX*

INFORMATION PERTAINING TO AFB LAB TESTING

SPECIMEN (collect in sterile leak proof container)

1. Requires three specimens on three consecutive days.
2. Best results come from 5-10 ml material expectorated by patient soon after awakening in the morning.
3. Specimen should be delivered to the laboratory within 24 hours.

AFB SLIDE EXAMINATION (ONE DAY)

1. Least sensitive of all AFB Tests.
2. Requires 100,000 AFB/ml for a slide to be positive.
3. If positive the patient can infect others.
4. Positive Slide – does not determine whether TB or MOTT.
5. Report within 24 hours of receiving the specimen in the laboratory.

DIRECT SPECIMEN PCR TB PROBE TEST (1-2 DAYS)

1. Very sensitive and very specific test.
2. Requires only one AFB to produce a positive result.
3. Performed only on non-bloody, pulmonary specimens.
4. Performed on the new patient's first slide positive specimen (not performed during treatment)
5. Report within 24 hours of the positive slide report.
6. Positive result (very reliable) – *Mycobacterium tuberculosis* complex (not MOTT).
7. Test not available in most laboratories.

AFB CULTURE (7-10 DAYS)

1. More sensitive than the AFB slide test.
2. Only requires 10 AFB/ml of specimen to produce a positive result.
3. Culture may be AFB positive even though the slide test was reported negative for AFB.
4. Rapid broth testing – normally positive within 1-2 weeks.

5. Positive culture result may be either *Mycobacterium tuberculosis* complex or MOTT
6. Negative culture results require 6 weeks to report.

AFB IDENTIFICATION (10-12 DAYS)

1. Performed as soon as culture becomes positive with growth of AFB.
2. Rapid preliminary identification may be reported within 1-3 days of a positive culture report.
3. Preliminary identification is based upon HPLC or genetic probe.
4. Genetic probe (growth based/non-PCR) reports *M.tuberculosis* complex or NOT *M.tuberculosis* complex.
5. HPLC – Identifies many *Mycobacterium* spp.

SUSCEPTIBILITY (WITHIN 21 DAYS)

1. Performed as soon as growth from culture has been identified as *M.tuberculosis* complex.
2. Primary antibiotic susceptibility report may be expected one week from the *M.tuberculosis* identification report.
3. Pyrazinamide susceptibility report may be expected one week after the primary drug report.
4. Secondary antibiotics may be requested to be tested and are reported approximately three weeks after initiated.

Available Laboratory Tests

The laboratory tests listed below in Table 1 are available where noted.

Table 1: AVAILABLE LABORATORY TESTS

Test	Laboratory	Turnaround Time
Diagnosis		
QuantiFERON®-TB Gold (QFT-G)	<i>Sparrow Hospital in Lansing Borgess Hospital in Kalamazoo University Hospital in Ann Arbor</i>	<i>Check with individual hospital.</i>
Acid-fast (AFB) bacilli smear	<i>Michigan Department of Community Health</i>	Within 24 hours from receipt in laboratory ³
Culture	<i>Michigan Department of Community Health</i>	Mycobacterial growth detection by culture within 14 days from date of specimen collection Identification of cultured mycobacteria within 21 days from date of specimen collection ^{4,5}
Drug susceptibility	<i>Michigan Department of Community Health</i>	Within 28 days from date of specimen collection ^{6,7}
Nucleic acid amplification (NAA) test	<i>Michigan Department of Community Health</i>	Within 1 day from date of positive AFB slide report
Epidemiologic Monitoring		
Genotyping	<i>Michigan Department of Community Health</i>	Spoligo/MIRU-10 days from TB identification

Laboratories should report positive smears or positive cultures, and primary healthcare providers should report suspected or confirmed cases of TB to the health department, as specified in the “Reporting Tuberculosis” topic in the Surveillance section. Prompt reporting allows the health department to organize treatment and case management services and to initiate a contact investigation as quickly as possible.⁸



For information on reporting, see the “Reporting Tuberculosis” topic in the Surveillance section.



For laboratory services available at MDCH and private laboratories located in Michigan contact the MDCH TB laboratory at (517) 335-9636.

Specimen Collection

Sputum is phlegm from deep in the lungs. The important characteristics needed in sputum specimens are freshness and actual sputum, rather than saliva. Three specimens collected early in the morning on three successive days will provide the most reliable results.

To isolate mycobacteria from clinical materials successfully, handle specimens carefully after collection. For optimal results, collect specimens in clean, sterile, leak proof containers and keep them in refrigerated conditions to inhibit the growth of contaminating organisms, since most specimens will contain bacteria other than mycobacteria.⁹

Refer to Table 2 to review the methods used to collect various specimens and the type of specimens obtained for pulmonary tuberculosis (TB).



NOTE: During specimen collection procedures in which aerosols may be produced, use appropriate respiratory protection and environmental controls. For more information, refer to the CDC's "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005" (*MMWR* 2005;54[No. RR-17]) at this hyperlink: <http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .

Table 2: SPECIMEN COLLECTION METHODS AND TYPES FOR PULMONARY TUBERCULOSIS

Pulmonary Tuberculosis	
Collection Method	Specimen Type
Spontaneous sputum collection occurs when the patient can cough up sputum without extra assistance.	<ul style="list-style-type: none"> ▪ 5–10 ml of sputum from deep in the lung
Induced sputum collection should be considered if a patient needs assistance in bringing up sputum.*	<ul style="list-style-type: none"> ▪ 5–10 ml of sputum from deep in the lung
Gastric aspirates can be submitted for the diagnosis of pulmonary tuberculosis (TB) in young children who cannot produce sputum. (Must be neutralized to pH7 and delivered to the laboratory within 72 hours of specimen collection)	<ul style="list-style-type: none"> ▪ 50 ml of gastric contents
Bronchoscopy can be used in the following situations: <ul style="list-style-type: none"> ▪ If a patient cannot produce sputum by the above three methods¹⁰ or ▪ If a patient has a substantial risk of drug-resistant TB 	<ul style="list-style-type: none"> ▪ Bronchial washings ▪ Bronchoalveolar lavage ▪ Transbronchial biopsy

<p>and has initial routine studies that are negative¹¹ or</p> <ul style="list-style-type: none"> ▪ In a patient in whom there is suspicion of endobroncheal TB¹² or ▪ If a variety of clinical specimens for the diagnosis of pulmonary TB or other possible diseases need to be obtained 	
<p>* It is important to specify if the sputum is induced or not, because induced sputum is “more watery” and appears to be just saliva. The laboratories may alter the testing process based upon the watery nature of the specimen.</p>	

Refer to Table 3 for collection methods and specimen types for extrapulmonary TB.

Table 3: SPECIMEN COLLECTION METHODS AND TYPES FOR EXTRAPULMONARY TUBERCULOSIS

Extrapulmonary Tuberculosis		
Collection Method	Specimen Type	
<p>Extrapulmonary specimen collection from tissue and other body fluids can be submitted for the diagnosis of extrapulmonary tuberculosis.</p>	<p>Examples of tissues (biopsy)*</p> <ul style="list-style-type: none"> ▪ Lymph node ▪ Pleural ▪ Bone/joint ▪ Kidney ▪ Peritoneal ▪ Pericardial 	<p>Examples of fluids</p> <ul style="list-style-type: none"> ▪ Pleural ▪ Cerebrospinal ▪ Blood ▪ Urine ▪ Synovial ▪ Peritoneal ▪ Pericardial
<p>* Do not place specimens in formalin.</p>		

How to Perform Spontaneous Sputum Collection at a Healthcare Facility

1. Collect the specimen in a specialized room or booth designed for cough-inducing procedures.
2. Instruct the patient on how to collect the sputum sample.
 - a. Put a mark at the 5 ml level on the sputum tube (if not already marked) to show the patient the minimum amount of sputum needed. (Most laboratories consider 5 to 10 ml an adequate amount.)
 - b. Review with the patient how to collect sputum.
3. Make sure that both the specimen container and laboratory requisition are filled out completely before shipping. If either the test requisition or the specimen are not labeled correctly, the specimen cannot be tested.

- a. On the specimen container, record the patient name and the date and time of collection.
4. Make sure the specimen and laboratory requisition are packaged into appropriate shipping containers, per laboratory instructions.
5. If possible, send the specimen on the day it is collected. If this is not possible, refrigerate the specimen until it is sent on the next day.
6. Do not delay sending specimens in order to send all three on the same day.
7. Use the most rapid transport to the laboratory: yourself, courier, overnight carrier, or US mail.



NOTE: Make every effort to submit specimens to the laboratory within 24 hours of collection. Normal flora can overgrow any mycobacteria in the specimen and make it unusable. If specimens cannot be submitted within 24 hours, keep in mind that most laboratories will not run a specimen over five days old. Know how long it takes the specimen to get to the laboratory from the time it leaves your hands, and submit specimens accordingly.

How to Direct a Patient to Perform Spontaneous Sputum Collection at Home

If a patient will be collecting sputum specimens at home, provide the following guidance.

1. Put a mark at the 5 ml level on the sputum tubes (if not already marked) to show the patient the minimum amount of sputum needed. (Most laboratories consider 5 to 10 ml an adequate amount.)
2. Review with the patient how to collect sputum.
3. Make arrangements for a healthcare worker to pick up the specimen or for the patient, a family member, or a friend to drop off the specimen.

Induced Sputum Collection at a Healthcare Facility

If the patient cannot produce sputum spontaneously, then make arrangements for an induced sputum to be collected at a facility. Facilities where sputum can be collected include the respiratory therapy department of a local hospital, TB clinic, or laboratory. Facilities should have appropriate respiratory protection, environmental controls, and policies and procedures.

How to Collect Gastric Aspirates

The following are basic guidelines for collecting gastric aspirates:

- Collect the specimen after the patient has fasted for eight to ten hours and, preferably, while the patient is still in bed.
- Collect a specimen daily for three consecutive days.



For additional information on how to collect a gastric aspirate and prepare the specimen for transport, see the guide and Francis J. Curry National Tuberculosis Center's online video *Pediatric TB: A Guide to the Gastric Aspirate (GA) Procedure* at this hyperlink:

http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=ONL-06 .

Bronchoscopy or Collection of Extrapulmonary Specimens

If TB staff are consulting with physicians before the specimens are collected, the physician should be reminded to send part of the specimen (not in formalin) to the microbiology laboratory for acid-fast bacilli (AFB) smear and culture, in addition to any other tests or pathology examinations the physician plans to obtain. In addition, a post-bronchoscopy sputum specimen should be sent for AFB smear and culture.

- **Bronchoscopy:** Refer the patient to a local specialist.
- **Extrapulmonary specimens:** These specimens will be collected by the physician performing the diagnostic work-up.

Specimen Shipment

In order to transport TB specimens or cultures, there are two primary categories of infectious substances, and each category has different packaging requirements to provide increased levels of protection against leaks and contamination.

Category A mycobacterial cultures (culture isolates suspected of being *Mycobacterium tuberculosis* complex) are Category A Infectious Substances and are only to be transported by a medical courier or shipped by private carrier as dangerous goods. Category A Infectious Substances cannot be mailed through the United States Postal Service (USPS).

Category B Infectious Substances (raw diagnostic specimens, such as sputum, blood, or tissue) can be mailed through the USPS, shipped by private carrier (e.g., Federal Express, Airborne Express, etc.), or transported by a medical courier.

Shipment of dangerous goods by the USPS is regulated by the United States Department of Transportation. Specific shipping instructions from the Centers for Disease Control and Prevention (CDC) can be found in the publication by the United States Department of Health and Human Services (DHHS) *Public Health Mycobacteriology: A Guide for the Level III Laboratory*. Packaging and shipment of specimens by USPS should meet the following regulations:

- Office of Health and Safety. "Interstate Shipment of Etiologic Agents" [Web page] (Centers for Disease Control and Prevention Website):
<http://www.cdc.gov/od/ohs/biosfty/shipregs.htm>
- United States Postal Service. Domestic Mail Manual:
http://pe.usps.com/text/dmm300/dmm300_landing.htm
- United States Postal Service. 135 Mailable Dangerous Goods (International Mail Manual): http://pe.usps.gov/text/lmm/immc1_013.htm
- National Archives and Records Administration. Code of Federal Regulations Title 39—United States Postal Service (U.S. Government Printing Office Website):
http://www.access.gpo.gov/nara/cfr/waisidx_03/39cfrv1_03.html
- National Archives and Records Administration. Code of Federal Regulations Title 49—Transportation (U.S. Government Printing Office Website):
http://www.access.gpo.gov/nara/cfr/waisidx_04/49cfrv2_04.html
- U.S. Department of Labor, Occupational Safety & Health Administration (OSHA): Occupational Health and Safety Standards 29 CFR 1910.1030:
http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910¹³

For shipments by private carriers, follow International Air Transportation Association (IATA) instructions. *Mycobacterium tuberculosis* cultures are defined as infectious substances/etiologic agents when shipped by private carrier and must be shipped in packaging approved by the United Nations (UN), according to IATA Packing Instruction

602. Diagnostic specimens are defined as human or animal specimens, including excreta, secreta, blood and its components, tissue, tissue fluids, and cultures of nontuberculous mycobacteria being transported for diagnostic or investigational purposes. Diagnostic specimens must be packaged according to IATA Packing Instruction 650. Please reference IATA instructions available at: http://www.iata.org/whatwedo/cargo/dangerous_goods/infectious_substances.htm¹⁴



To obtain specimen collection and transport supplies, contact MDCH by phone @ (517) 335-9867 or by e-mail @ <http://www.michigan.gov/mdchlab>

Resources and References

Detailed descriptions of recommended laboratory tests; recommendations for their correct use; and methods for collecting, handling, and transporting specimens have been published. For more information on laboratory testing for tuberculosis (TB), see the following:

- ATS, CDC, IDSA. "Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America" (*MMWR* 2005;54[No. RR-12]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5412.pdf> .
- ATS, CDC, IDSA. "Diagnostic Standards and Classification of Tuberculosis in Adults and Children" (*Am J Respir Crit Care Med* 2000;161[4 Pt 1]). Available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- National Committee for Clinical Laboratory Standards. *Susceptibility Testing of Mycobacteria, Nocardiae, and Other Aerobic Actinomycetes; Approved Standard* [Document no. M24-A] (Wayne, PA; 2003).

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):18.
- ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁵ CDC. National plan for reliable tuberculosis laboratory services using a systems approach - recommendations from CDC and the Association of Public Health Laboratories Task Force on Tuberculosis Laboratory Services. *MMWR* 2005;54(No. RR-6):2.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁷ CDC. National plan for reliable tuberculosis laboratory services using a systems approach - recommendations from CDC and the Association of Public Health Laboratories Task Force on Tuberculosis Laboratory Services. *MMWR* 2005;54(No. RR-6):2.
- ⁸ CDC. Diagnostic microbiology. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ⁹ ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med*. 2000;161:1376–1395.
- ¹⁰ Iseman, MD. *A Clinician's Guide to Tuberculosis, 2000*. 1st ed. Philadelphia, PA: Williams & Wilkins; 2000:135–136.
- ¹¹ Iseman, MD. *A Clinician's Guide to Tuberculosis, 2000*. 1st ed. Philadelphia, PA: Williams & Wilkins; 2000:135–136.
- ¹² Iseman, MD. *A Clinician's Guide to Tuberculosis, 2000*. 1st ed. Philadelphia, PA: Williams & Wilkins; 2000:135–136.
- ¹³ National Jewish Medical and Research Center. *How to Mail Specimens and Cultures to the National Jewish Mycobacteriology Laboratory*. Denver, CO; March 2005:2.
- ¹⁴ National Jewish Medical and Research Center. *How to Mail Specimens and Cultures to the National Jewish Mycobacteriology Laboratory*. Denver, CO; March 2005:5–7.

Diagnosis of Tuberculosis Disease

CONTENTS

- Introduction5.2**
 - Purpose..... 5.2
 - Policy 5.3
 - Forms..... 5.3
- Case Finding5.4**
 - Identifying suspected tuberculosis cases..... 5.4
 - Follow-up on suspected cases of tuberculosis 5.6
- Diagnosis of Tuberculosis Disease... ..5.7**
 - Medical history5.8
 - Human immunodeficiency virus screening5.11
 - Physical examination5.11
 - Tuberculin skin test and
interferon gamma release assays.....5.11
 - Chest radiography.....5.13
 - Bacteriologic examination.....5.14
- Resources and References5.17**

Introduction

Purpose

Use this section to understand and follow national, State Of Michigan and MIACET guidelines to do the following:

- Classify patients with tuberculosis (TB) disease and latent TB infection (LTBI).
- Detect suspected cases of TB.
- Know when to report suspected or confirmed cases of TB.
- Diagnose TB disease.

It is important to understand when a person should be evaluated further for TB disease. Not recognizing TB symptoms promptly leads to delays in treating a TB case, and thus to increased risk for TB transmission and TB disease among contacts to the case.

In the 2005 guideline, “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America,” one of the recommended strategies to achieve the goal of reduction of TB morbidity and mortality is early and accurate detection, diagnosis, and reporting of TB cases, leading to initiation and completion of treatment.¹



Contacts are mentioned within this section, but the investigation, evaluation and follow-up of contacts are covered in more depth in the Contact Investigation section. For information on treatment, refer to the Treatment of Tuberculosis Disease section.

Improvement in the detection of TB cases is essential to progress toward elimination of TB in the United States.² Case detection includes the processes that lead to the presentation, evaluation, diagnosis and reporting of persons with active TB.³ Detecting and reporting suspected cases of TB are key steps in stopping transmission of TB because they lead to prompt initiation of effective multiple-drug treatment, rapidly reducing infectiousness.⁴

Tuberculosis may be diagnosed under a variety of circumstances. Patients may seek medical attention for symptoms caused by the disease or a concomitant medical condition, or may present for routine evaluation of TB infection pursuant to employment or occupational health policies. Thus, healthcare providers, particularly those providing primary care to populations at high risk or performing a large volume of routine TB testing, are key contributors to TB case detection.⁵ Unfortunately, many TB cases among low-income, substance-abusing, homeless or other high-risk populations remain undiagnosed until an advanced stage. Earlier diagnosis would result in less individual

morbidity and death, greater success in treatment, less transmission to contacts, and fewer outbreaks of TB.⁶

A diagnosis of TB disease may be based on positive cultures for *M. tuberculosis*, but the patient's clinical context is always critical in diagnosing TB and the disease may be diagnosed on the basis of clinical signs and symptoms in the absence of a positive culture. In addition, a variety of preliminary tests can also support a diagnosis of TB.

Policy

In Michigan:

- Persons who show or report signs and symptoms of TB should be evaluated for TB disease as described in the “Diagnosis of Tuberculosis Disease” topic in this section and reported as suspected cases of TB, as described in the “Reporting Tuberculosis” topic in the Surveillance section.
- Contacts should be evaluated as described in the Contact Investigation section.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

Per State Of Michigan Communicable Disease rules, tuberculosis is designated as a serious communicable disease (R 325.172), and must be reported within 24 hours of diagnosis or discovery, to the appropriate health department (R 325.173).

Forms



Tuberculosis cases are reported electronically through the Michigan Disease Surveillance System (MDSS). Consult with your local health department to report confirmed and suspected cases of TB. Contact information for all local health departments in Michigan is available online at:
<http://www.michigantb.org/hcp/documents/MichiganLocalHealthDepartments.pdf>

Case Finding

Identifying Suspected Tuberculosis Cases

The majority of tuberculosis (TB) cases are detected during the medical evaluation of symptomatic illnesses. Persons experiencing symptoms ultimately attributable to TB usually seek care not at a public health TB clinic but rather from other medical practitioners in other healthcare settings.⁷ Professionals in the primary healthcare sector, including hospital and emergency department clinicians, should be trained to recognize patients with symptoms consistent with TB.⁸

Be alert for TB disease among persons recently diagnosed with TB infection and among persons identified as contacts to patients with pulmonary TB, but who have not sought medical care. Screen for TB infection and disease when evaluating immigrants and refugees with Class B1 or Class B2 TB notification status, persons involved in TB outbreaks, populations with a known high incidence of TB and when the consequences of an undiagnosed case of TB are severe (e.g. correctional facilities).⁹



Factors that identify persons at high risk of LTBI infection and/or of progression to TB disease are listed in the “High-Risk Groups” topic in the section on Diagnosis of Latent Tuberculosis Infection.

Suspect pulmonary TB and initiate a diagnostic investigation when the historic features, signs, symptoms, and radiographic findings listed in Table 1 occur among adults. The clinical presentation of TB varies considerably as a result of the extent of the disease and the patient’s response. TB should be suspected in any patient who has a persistent cough for more than two to three weeks, or other compatible signs and symptoms.¹⁰

Note that these symptoms should suggest a diagnosis of TB but are not required. TB should still be considered a diagnosis in asymptomatic patients who have risk factors for TB and chest radiographs compatible with TB.



All persons who have a chronic cough for more than two to three weeks¹¹ should be evaluated and be asked to use a mask or tissue to cover their mouth. Hemoptysis, or coughing up blood, is a serious symptom, and patients who cough up blood should be evaluated as soon as possible. Be sure to have these patients use a mask and tissues.

Table 1: WHEN TO SUSPECT PULMONARY TUBERCULOSIS IN ADULTS¹²

Historic Features	<ul style="list-style-type: none"> ▪ Exposure to a person with infectious tuberculosis (TB) ▪ Positive test result for <i>Mycobacterium tuberculosis</i> infection ▪ Presence of risk factors, such as immigration from a high-prevalence area, human immunodeficiency virus (HIV) infection, homelessness, or previous incarceration* ▪ Diagnosis of community-acquired pneumonia that has not improved after 7 days of treatment †,13
Signs and Symptoms Typical of TB	<ul style="list-style-type: none"> ▪ Prolonged coughing (≥ 2 weeks) with or without production of sputum that might be bloody (hemoptysis)§,14 ▪ Chest pain¹⁵ ▪ Chills¹⁶ ▪ Fever ▪ Night sweats ▪ Loss of appetite¹⁷ ▪ Weight loss ▪ Weakness or easy fatigability¹⁸ ▪ Malaise (a feeling of general discomfort or illness)¹⁹
Chest Radiograph: Immunocompetent patients	<ul style="list-style-type: none"> ▪ Classic findings of TB are upper-lobe opacities, frequently with evidence of contraction, fibrosis and cavitation¶
Chest Radiograph: Patients with advanced HIV infection	<ul style="list-style-type: none"> ▪ Lower-lobe and multilobar opacities, hilar adenopathy, or interstitial opacities might indicate TB
<p>* See Table 1: Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease in the section on Diagnosis of Latent Tuberculosis Infection.</p> <p>† Patients treated with levofloxacin or moxifloxacin may have a clinical response when TB is the cause of the pneumonia.</p> <p>§ Do not wait until sputum is bloody to consider a productive cough a symptom of TB. Sputum produced by coughing does not need to be bloody to be a symptom of TB.</p> <p>¶ These features are not specific for TB, and, for every person in whom pulmonary TB is diagnosed, an estimated 10–100 persons are suspected on the basis of clinical criteria and must be evaluated.</p>	

Source: Adapted from: ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.

Extrapulmonary Tuberculosis

If a patient has a positive tuberculin skin test or interferon gamma release assay (IGRA), consider signs and symptoms of extrapulmonary TB.

Follow-up on Suspected Cases of Tuberculosis

When a suspected case of TB is identified, the following should be done:



Report all suspected cases of TB to your local health department. See the “Reporting Tuberculosis” topic in the Surveillance section.



When a suspected case of pulmonary TB is identified, refer to Table 2: **Guidelines for the Evaluation of Pulmonary Tuberculosis in Adults in Five Clinical Scenarios** in the “Diagnosis of Tuberculosis Disease” topic in this section. This table presents guidelines for the initial steps of TB case detection in five clinical scenarios encountered by providers of primary health care, including those serving in medical emergency departments.²⁰



If pulmonary TB disease is suspected, the patient should be masked and immediately excluded from the workplace or placed in airborne infection isolation (All) until confirmed noninfectious. For more information, see the “Isolation” topic in the Infection Control section of this manual.



Laboratories should report positive smears or positive cultures to the local health department as specified in the “Reporting Tuberculosis” topic in the Surveillance section. Prompt reporting allows the local health department to organize treatment and case management services and to initiate a contact investigation as quickly as possible.²¹



Within 48 hours of suspect identification, administer a tuberculin skin test (TST) or perform an interferon gamma release assay (IGRA) and/or provide a chest radiograph. Evaluate the patient for TB disease as specified in the “Diagnosis of Tuberculosis Disease” topic in this section.



For a summary of the TB classification numbers, refer to the “Tuberculosis Classification System” topic in the Surveillance section.

Diagnosis of Tuberculosis Disease

Consideration of tuberculosis (TB) disease as a possible diagnosis is the first step that must be taken before further evaluation, diagnosis, and management can occur. The diagnosis of TB disease is often overlooked because of the failure to consider it among possible diagnoses. While a definitive diagnosis may involve the addition of laboratory and radiographic findings, a high degree of suspicion can be based on epidemiology, medical history, and physical examination. In considering TB disease, it is also important to consider factors that may affect the typical presentation of TB, such as the patient's age, nutritional status, and coexisting diseases.

An individual who is suspected of having TB disease requires a complete medical evaluation, including the following:

- Medical history including exposure, symptoms, previous treatment for TB and risk factors
- Human immunodeficiency virus (HIV) screening
- Physical examination
- Tuberculin skin test (TST) or interferon gamma release assay (IGRA)
- Chest radiography
- Bacteriologic examination

Table 2: GUIDELINES FOR THE EVALUATION OF PULMONARY TUBERCULOSIS IN ADULTS IN FIVE CLINICAL SCENARIOS²²

Patient and Setting	Recommended Evaluation
Any patient with a cough of ≥ 2 weeks' duration	Chest radiograph: If suggestive of tuberculosis (TB)*, collect 3 sputum specimens for acid-fast bacilli (AFB) smear microscopy, culture, and nucleic acid amplification (NAA), if available ²³
Any patient at high risk for TB with an unexplained illness, including respiratory symptoms of ≥ 2 weeks' duration†	Chest radiograph: If suggestive of TB, collect 3 sputum specimens for AFB smear microscopy, culture, and NAA, if available
Any patient with human immunodeficiency virus (HIV) infection and unexplained cough or fever	Chest radiograph, and collect 3 sputum specimens for AFB smear microscopy, culture, and NAA, if available
Any patient at high risk for TB with a diagnosis of community-acquired pneumonia who has not improved after 7 days of treatment†	Chest radiograph, and collect 3 sputum specimens for AFB smear microscopy, culture, and NAA, if available
Any patient at high risk for TB with incidental findings on chest radiograph suggestive of TB even if symptoms are minimal or absent‡	Review of previous chest radiographs, if available; collect 3 sputum specimens for AFB smear microscopy, culture, and NAA, if available
<p>* Opacities with or without cavitation in the upper lobes or the superior segments of the lower lobes.²⁴</p> <p>† See Table 1: Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease in the section on Diagnosis of Latent Tuberculosis Infection.</p> <p>‡ Chest radiograph performed for any reason, including targeted testing for latent TB infection and screening for TB disease.</p>	

Source: Adapted from: ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.

Medical History

The clinician should interview patients to document their medical histories. A written record of a patient's medical history should include the following:

- Exposure to infectious TB
- Symptoms of TB disease (as listed in Table 1: **When to Suspect Pulmonary Tuberculosis in Adults**, Table 2: **Guidelines for the Evaluation of Pulmonary Tuberculosis in Adults in Five Clinical Scenarios**, and Table 3: **Symptoms of Tuberculosis Disease**)
- Previous TB infection or disease
- Risk factors (as listed in Table 1: **Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease** in the section on Diagnosis of Latent Tuberculosis Infection)
- Recent medical encounters (e.g., going to the emergency department for pneumonia)
- Previous antibiotic therapy

1. Exposure to Infectious TB:

Ask patients if they have spent time with someone with infectious TB.

Question patients about whether they know of any contact in the recent or distant past with persons diagnosed with pulmonary or laryngeal TB. It is important to note that patients often refer to latent TB infection (LTBI) as TB disease. Be aware that most persons become infected with TB without knowing they were exposed. Clinicians should also consider demographic factors that may increase a patient's risk for exposure to TB disease and drug-resistant TB, such as country of origin, age, ethnic or racial group, occupation, and residence in congregate settings (such as a jail, homeless shelter, or refugee camp).

2. Symptoms of TB Disease:

Ask patients about their symptoms.

Although TB disease does not always produce symptoms, most patients with TB disease have one or more symptoms that led or may lead them to seek medical care. When symptoms are present, they usually have developed gradually and been present for weeks or even months. Occasionally, however, TB is discovered during a medical examination for an unrelated condition, such as ruling out a cancer diagnosis (e.g., through a chest radiograph given to patients before surgery).

The symptoms in Table 3 below may be caused by other diseases, but they should prompt the clinician to suspect TB disease. For historic features and chest radiograph results that should raise suspicion of pulmonary TB disease, refer to Table 1: **When to Suspect Pulmonary Tuberculosis in Adults.**

Table 3: SYMPTOMS OF TUBERCULOSIS DISEASE²⁵

Pulmonary	General: Pulmonary and Extrapulmonary	Extrapulmonary
<ul style="list-style-type: none"> ▪ Coughing ▪ Coughing up sputum or blood ▪ Pain in the chest when breathing or coughing 	<ul style="list-style-type: none"> ▪ Chills²⁶ ▪ Fever ▪ Night sweats ▪ Loss of appetite²⁷ ▪ Weight loss ▪ Weakness or easy fatigability²⁸ ▪ Malaise (a feeling of general discomfort or illness)²⁹ 	<p>The symptoms depend on site of TB disease:</p> <ul style="list-style-type: none"> ▪ TB of the spine may cause pain in the back. ▪ TB of the kidney may cause blood in the urine. ▪ Meningeal TB may cause headaches or psychiatric symptoms. ▪ Lymphatic TB may cause swollen and tender lymph nodes, often at the base of the neck.

Source: Adapted from: ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.

3. Previous Latent TB Infection or TB Disease:

Ask patients whether they have ever been diagnosed with or treated for TB infection or disease.

- **Patients who have had TB disease before** should be asked when they had the disease and how the disease was treated. Ask how many pills were taken per day (to determine what treatment regimen was used and whether they received injections). Be aware that many patients will not remember the number of pills they took or the names of the medications. Therefore it may be necessary to coach or prompt patients on this point. If the regimen prescribed was inadequate or if the patient did not follow the recommended treatment, TB may recur, and it may be resistant to one or more of the drugs used.
- **Patients known to have a positive skin test reaction** probably have TB infection. If they were infected within the past two years, they are at high risk for TB disease if certain immunosuppressive conditions exist or if immunosuppressive therapies are being taken. (See Table 1: **Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease** in the section on Diagnosis of Latent Tuberculosis Infection.)³⁰ For persons previously skin tested, an increase in induration of 10 mm within a two-year period is classified as a conversion to positive.

4. Risk Factors for Developing TB Disease:

Determine whether patients have any conditions or behaviors that are risk factors for developing TB disease.

For a list of behaviors and conditions that appear to increase the risk that TB infection will progress to disease, see Table 1: **Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease** in the section on Diagnosis of Latent Tuberculosis Infection.

Human Immunodeficiency Virus Screening

Voluntary counseling and testing for human immunodeficiency virus (HIV) is recommended for all patients with TB. HIV counseling and testing has also been recommended for contacts of persons with TB.³¹

The Centers for Disease Control and Prevention (CDC) recommends the following:

- Routine HIV screening for all patients ages 13–64 seeking health care for any reason, without regard to any patient’s known risks for HIV infection
- Annual HIV screening of patients known to be at high risk³²

Physical Examination

A physical examination is an essential part of the evaluation of any patient. It cannot be used to confirm or rule out TB, but it can provide valuable information about the patient’s overall condition; other factors, such as human immunodeficiency virus (HIV) infection, which may affect how TB is manifested; and the presence of extrapulmonary TB.³³

Tuberculin Skin Test and Interferon Gamma Release Assays



For information on interferon gamma release assays (IGRAs), refer to the “Interferon Gamma Release Assays” topic in the section on Diagnosis of Latent Tuberculosis Infection.

Use the Mantoux tuberculin skin test (TST) or an interferon gamma release assay (IGRA) to test for TB infection. Note that for patients with a previous documented positive TST reaction, a TST is not necessary. However, an IGRA can be done if there is suspicion that the TST result was a false positive. Additional tests, such as chest radiography and bacteriologic examination, are required to confirm TB disease.

For both the TST and IGRA, additional tests, such as chest radiography and bacteriologic examination, are required to confirm TB disease.³⁴

Persons with a positive TST, QFT-G, or QFT™ result, regardless of signs or symptoms, should be evaluated for TB disease before LTBI is diagnosed. At minimum, a chest radiograph should be examined for abnormalities consistent with TB disease.³⁵

A negative TST does not rule out TB disease³⁶—as many as 20% of patients with TB disease have a negative TST reaction.³⁷ A negative TST, QFT-G, or QFT™ result should not be used alone to exclude TB infection in persons with symptoms or signs suggestive of TB disease. Medical evaluation of such persons should include a history and physical examination, chest radiograph, bacteriologic studies, serology for human immunodeficiency virus (HIV), and, when indicated, other tests or studies.³⁸



For more information on the Mantoux TST, see the Diagnosis of Latent Tuberculosis Infection section. For more information on IGRAs and the QuantiFERON®-TB Gold (QFT-G) Test, see the CDC's "Guidelines for Using the QuantiFERON®-TB Gold Test for Detecting *Mycobacterium tuberculosis* Infection, United States" (*MMWR* 2005;54[No. RR-15]) available at: <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf> .

Chest Radiography

A posterior-anterior radiograph of the chest is the standard view used for the detection and description of chest abnormalities in adults. In some instances, other views (e.g., lateral, lordotic) or additional studies (e.g., computed tomography [CT] scans) may be necessary.



Children younger than five years of age should receive posterior-anterior and lateral radiographs.³⁹

Certain abnormalities on chest radiographs are suggestive, but not diagnostic, of TB. In pulmonary TB, radiographic abnormalities are often seen 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 presence or absence of cavitation, especially in HIV-infected and other immunosuppressed persons.

In HIV-infected persons, pulmonary TB may present atypically on the chest radiograph. For example, TB may cause opacities without cavities in any lung zone, or it may cause mediastinal or hilar lymphadenopathy with or without accompanying opacities and/or cavities. In HIV-infected persons, almost any abnormality on a chest radiograph may indicate TB. In fact, the radiograph of an HIV-infected person with TB disease may even appear entirely normal.⁴⁰



For more information on chest radiography, see the Francis J. Curry National Tuberculosis Center's *Radiographic Manifestations of Tuberculosis: A Primer for Clinicians* (2006) at this hyperlink:

http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-04

Bacteriologic Examination

Refer to Table 4 below to determine the types of specimens needed to assist in the diagnosis of TB.

Table 4: SPECIMENS FOR DIAGNOSING TUBERCULOSIS DISEASE

Suspected Diagnosis	Specimen Needed
Pulmonary or laryngeal tuberculosis (TB)	<p>Sputum (phlegm from deep in the lungs) samples for smear and culture examination.</p> <p>If a diagnosis of pulmonary TB cannot be established from sputum smear, other procedures may be necessary, including nucleic acid amplification (NAA), bronchoscopy, and gastric aspiration in children.</p>
Extrapulmonary TB	<p>Depending on the anatomical site, other clinical specimens are necessary, such as:</p> <ul style="list-style-type: none">▪ Urine▪ Cerebrospinal fluid▪ Pleural fluid▪ Pus or other aspirated fluid▪ Biopsy specimens

Refer to Table 5 below for information on the bacteriologic tests used to diagnose TB.

Table 5: BACTERIOLOGIC TESTS USED IN DIAGNOSING TUBERCULOSIS DISEASE⁴¹

Test	Description	Laboratory Turnaround Times
Acid-Fast Bacilli (AFB) Smear	<ul style="list-style-type: none"> Provides the physician with a preliminary confirmation of the diagnosis. It usually is the first bacteriologic evidence of the presence of mycobacteria in a clinical specimen. If positive, gives a semiquantitative estimate of the number of bacilli being excreted (which is of vital clinical and epidemiologic importance in assessing the patient's infectiousness). 	<ul style="list-style-type: none"> On-site test: within 24 hours from specimen collection Off-site test: within 24 hours from laboratory receipt of specimen (time from specimen collection to laboratory receipt should be 24 hours or less)⁴²
Nucleic Acid Amplification (NAA) Assay ⁴³	<ul style="list-style-type: none"> A test done on sputum specimens for the direct and rapid identification of the <i>Mycobacterium tuberculosis</i> complex. Allows for the amplification of specific target sequences of nucleic acids that will be detected by a nucleic acid probe. Does not replace the need for routine AFB smear and culture.⁴⁴ 	<ul style="list-style-type: none"> Within 48 hours from specimen collection^{45,46}, or from laboratory receipt of specimen if testing is performed off-site.
Culture	<ul style="list-style-type: none"> Usually necessary for species identification of all clinical specimens suspected of containing mycobacteria. Required for drug susceptibility testing and genotyping. 	<ul style="list-style-type: none"> On-site testing: Mycobacterial growth detection within 14 days from specimen collection; species identification within 21 days of specimen collection^{51,52} Off-site testing: Mycobacterial growth detection within 14 days of receipt of specimen; species identification within 21 days of receipt of specimen
Drug Susceptibility Testing	<ul style="list-style-type: none"> For first-line drugs: performed on initial isolates of all patients to identify an effective antituberculosis regimen. For both first-line and second-line drugs: repeated on interim isolates when a patient remains culture-positive after 3 months of treatment.^{47,48} 	<ul style="list-style-type: none"> On-site testing: first-line drugs within 30 days from specimen collection; second-line drugs within 4 weeks from date of request Off-site testing: first-line drugs within 30 days from laboratory receipt of specimen; second-line drugs within 4 weeks from laboratory receipt of specimen

Sources: ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993;767-770.

Laboratories should report positive smears or positive cultures, and primary healthcare providers should report suspected or confirmed cases of TB to the health department, as specified in the “Reporting Tuberculosis” topic in the Surveillance section. Prompt reporting allows the health department to organize treatment and case management services and to initiate a contact investigation as quickly as possible.⁴⁹



For information on reporting, see the “Reporting Tuberculosis” topic in the Surveillance section.



For a list of all of the laboratory services available and information on specimen collection and shipment, see the Laboratory Services section.

Resources and References

Resources

- ATS, CDC, IDSA. “Diagnostic Standards and Classification of Tuberculosis in Adults and Children” (*Am J Respir Crit Care Med* 2000;161[4 Pt 1]). Available at: <http://www.thoracic.org/sections/publications/statements/pages/archive/tbadult1-20.html>
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- CDC. *Core Curriculum on Tuberculosis (2000)* (Division of Tuberculosis Elimination Web site; updated November 2001). Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm
- Tenover, R., et al. “The Resurgence of Tuberculosis: Is Your Laboratory Ready?” (*Journal of Clinical Microbiology* 1993;767–770).

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15–16.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ⁷ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ⁸ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ⁹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):34.
- ¹⁰ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ¹¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ¹² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33; CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006; CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11; ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med*. 2000;161:1378; CDC. Module 3: diagnosis of tuberculosis infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:3. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.

-
- ¹³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ¹⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ¹⁵ CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006; and CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11.
- ¹⁶ CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006; and CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11.
- ¹⁷ ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161:1378; CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11; and CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ¹⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11; and ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161:1378.
- ¹⁹ CDC. Module 3: diagnosis of tuberculosis infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:3. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006; and CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11.
- ²⁰ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ²¹ CDC. Diagnostic microbiology. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ²² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):33.
- ²³ Washington State Public Laboratory Tuberculosis Unit. Internal untitled report on the review, analysis, and recommendations on the Gen-Probe Amplified *Mycobacterium Tuberculosis* Direct Test (MTD). January 2004. The report includes the following references: (1) Gen-Probe Incorporated. *Amplified Mycobacterium Tuberculosis Direct Test Package Insert*. San Diego, CA: 2001; (2) ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161; (3) Piersimoni, C and Scarparo, C. Relevance of commercial amplification methods for direct detection of *Mycobacterium tuberculosis* complex in clinical samples. *J Clin Micro* December 2003;5355-5365; (4) CDC. Update: nucleic acid amplification tests for tuberculosis. *MMWR* 2000;49:593-594; (5) Schluger, NW. Changing approaches to the diagnosis of tuberculosis. *Am J Respir Crit Care Med* 2001;164:2020; (6) Catanzaro et al. The role of clinical suspicion in evaluation as a new diagnostic test for active tuberculosis. *JAMA* February 2, 2000;283(5):639.
- ²⁴ Daley CL, Gotway MB, Jasmer RM. *Radiographic manifestations of tuberculosis: a primer for clinicians*. San Francisco, CA: Francis J. Curry National Tuberculosis Center; 2003:1–30.
- ²⁵ CDC. "The medical history." In: Module 3: diagnosis of TB infection and disease *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:12. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ²⁶ CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)*. Updated November 2001; and CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11.
- ²⁷ ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000; 161:1378; CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11; and CDC. "Medical evaluation." In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)*. Updated November 2001.
- ²⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11; and ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161:1378.
- ²⁹ CDC. Module 3: diagnosis of TB tuberculosis infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:3. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006; and CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):11.

-
- ³⁰ CDC. The medical history. In: Module 3: diagnosis of TB infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:12. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ³¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):51.
- ³² CDC. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR* 2006;55(No. RR-14):1–17.
- ³³ CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006; and Colorado Department of Public Health and Environment. *Tuberculosis Manual* [Colorado Department of Public Health and Environment Web site]. 2004:3-1. Available at: <http://www.cdph.state.co.us/dc/TB/tbman.html> . Accessed November 1, 2006.
- ³⁴ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):52.
- ³⁵ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):52.
- ³⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):3.
- ³⁷ CDC. Module 3: diagnosis of TB infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:13. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ³⁸ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):52.
- ³⁹ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):25.
- ⁴⁰ CDC. Medical evaluation. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ⁴¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁴² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁴³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19.
- ⁴⁴ ATS, CDC, IDSA. Diagnostic standards and classification of tuberculosis in adults and children. *Am J Respir Crit Care Med* 2000;161:1384.
- ⁴⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):19; and Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:767–770.
- ⁴⁶ CDC. National plan for reliable tuberculosis laboratory services using a systems approach—recommendations from CDC and the Association of Public Health Laboratories Task Force on Tuberculosis Laboratory Services. *MMWR* 2005;54(No. RR-6):3.
- ⁴⁷ Tenover, R., et al. The resurgence of tuberculosis: is your laboratory ready? *Journal of Clinical Microbiology* 1993:769; and ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):38.
- ⁴⁸ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):12.
- ⁴⁹ CDC. Diagnostic microbiology. In: Chapter 5: diagnosis of TB. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.

Treatment of Tuberculosis Disease

CONTENTS

Introduction.....	6.2
Purpose.....	6.2
Policy	6.2
Basic Treatment Principles	6.3
Treatment Regimens and Dosages.....	6.5
Regimens.....	6.5
Dosages.....	6.9
Duration of treatment	6.13
Side Effects and	
Adverse Reactions	6.15
Basic monitoring steps.....	6.15
Reporting reactions.....	6.17
Monitoring for side effects and adverse reactions by antituberculosis drug	6.18
Response to Treatment.....	6.25
Completion of Therapy	6.26
Post-Treatment Evaluation	6.27
Treatment in Special Situations	6.28
Drug-resistant tuberculosis	6.28
Human immunodeficiency virus infection.....	6.29
Alcoholism.....	6.30
Liver disease.....	6.32
Renal insufficiency and end-stage renal disease.....	6.32
Tuberculosis associated with tumor necrosis factor-alpha antagonists.....	6.35
Culture-negative pulmonary tuberculosis.....	6.36
Extrapulmonary tuberculosis.....	6.36
Pregnancy and breastfeeding	6.37
Tuberculosis in children	6.38
Resources and References	6.39

Introduction

Purpose

The goals for treatment of tuberculosis (TB) are to cure the patient and to minimize the transmission of TB to others. In the 2005 “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America,” one of the recommended strategies to achieve the goal of reduction of TB morbidity and mortality is the early and accurate detection, diagnosis, and reporting of TB cases, leading to initiation and completion of treatment.¹ Successful treatment of TB has benefits both for the individual patient and for the community in which the patient resides.

Use this section to understand and follow national, State of Michigan and MIACET guidelines to do the following:

- Follow basic treatment principles for TB disease.
- Select appropriate treatment regimens, dosages, and duration.
- Monitor patients for side effects and adverse reactions.
- Assess patients’ response to treatment.
- Determine completion of therapy.
- Determine the need for post-treatment evaluation.
- Provide treatment in special situations, such as when a patient has drug-resistant TB or TB–human immunodeficiency virus (HIV) coinfection.
- Hospitalize and coordinate hospital discharge of patients with infectious TB.

Policy

The powers and duties of local health departments relating to treatment of tuberculosis are covered in Sections 333.2451, 333.5117, 333.5203, 333.5205, 333.5207 and 333.5301 of the Michigan Compiled Laws. Requirements for reporting suspected or confirmed cases of tuberculosis are described in 325.171 through 325.173 of the MDCH Communicable Disease Rules. Patients diagnosed with TB disease in Michigan or who move to Michigan with reported TB disease, should receive and complete treatment in accordance with the national guidelines set forth in the 2003 CDC MMWR publication, “Treatment of Tuberculosis” and other relevant guidelines available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

Basic Treatment Principles

Follow the basic treatment principles for tuberculosis (TB) disease, as outlined below in Table 1.

Table 1: BASIC TREATMENT PRINCIPLES FOR TUBERCULOSIS DISEASE

Phase	Principles
At Start of Treatment	Patient-centered care and directly observed therapy (DOT). An adherence plan should tailor treatment and supervision to each patient by considering his or her clinical and social circumstances (patient-centered care), and emphasize DOT as the standard of care for all patients.
	Cultural competence. It is imperative to become culturally competent and guide other healthcare providers toward culturally competent healthcare. A culturally competent system acknowledges cultural differences regarding healthcare and incorporates them into all levels of the healthcare delivery system, from policy to provider to patient.
	Human immunodeficiency virus (HIV) testing. HIV testing should be offered to all patients with TB disease.
	Medical supervision. Patients with confirmed or suspected tuberculosis (TB) disease must be under the medical supervision of a licensed provider in current good standing. Physicians lacking experience in treating TB should seek medical consultation through their local health department or the MDCH TB Control Program at 517-335-8165. When faced with suspected or confirmed drug-resistance, seek medical consultation through the local health department and the MDCH TB Control Program at 517-335-8165.
	Prompt start. Start patients with confirmed or suspected TB disease promptly on appropriate treatment. It is not necessary to wait for laboratory confirmation.
Regimen During Treatment	Multiple drugs. Treatment regimens must contain multiple drugs to which the organism is susceptible. The administration of a single drug or the addition of a single drug to a failing regimen can lead to the development of resistance.
	Single doses. TB medications should be administered together as a single dose rather than in divided doses. A single dose leads to higher and potentially more effective peak serum concentrations, and facilitates DOT. Although ingesting the medications with food will delay or moderately decrease the absorption of the medications, the effects are of little clinical significance.

Phase	Principles
	<p>Pyridoxine to prevent neuropathy. Pyridoxine (Vitamin B-6, 25 mg) is recommended for some individuals receiving isoniazid (INH) as part of their treatment regimen to prevent peripheral neuropathy. It should be used in persons at risk for neuropathy (women who are pregnant or breastfeeding or persons with nutritional deficiency, diabetes, HIV infection, renal failure, or alcoholism).</p>
<p>Persistent Positive Cultures</p>	<p>Evaluation when positive cultures persist. Monitor for culture conversion and promptly evaluate patients with persistently positive cultures after 3 months of therapy to identify the cause. Treatment failure is defined as continued or recurrent positive cultures after 4 months of treatment. In any case of continued positive cultures after 3 months of therapy, seek consultation through the local health department and the MDCH TB Control Program at 517-335-8165.</p>
<p>At Completion of Treatment</p>	<p>Completion in terms of the number of doses and the duration of therapy. Treatment completion is defined primarily as the ingestion of the total number of doses prescribed within the specified time frame. The duration of therapy depends on the drugs used, the drug-susceptibility test results of the isolate, and the patient's response to therapy.</p>

Treatment Regimens and Dosages

Use this information to do the following:

- Identify the appropriate regimen.
- Determine the appropriate dosage for each drug.
- Determine the duration of treatment.

The information in this topic was provided using guidelines for treating tuberculosis (TB) that have been developed by the American Thoracic Society (ATS), Centers for Disease Control and Prevention (CDC), and Infectious Diseases Society of America (IDSA).



See the “Treatment in Special Situations” topic in this section for information on treatment when there is drug-resistant TB, human immunodeficiency virus (HIV) infection, liver disease, or renal disease; when the patient is taking tumor necrosis factor-alpha (TNF- α) antagonists; where there is culture-negative TB or extrapulmonary TB; when the patient is pregnant or breastfeeding; or when the patient is considered to be of pediatric age.

As you use this section, remember the abbreviations for first-line drugs, which are listed below.

Table 2: ABBREVIATIONS FOR FIRST-LINE DRUGS

<ul style="list-style-type: none">▪ Ethambutol: EMB▪ Isoniazid: INH▪ Pyrazinamide: PZA	<ul style="list-style-type: none">▪ Rifabutin: RFB▪ Rifampin: RIF▪ Rifapentine: RPT
--	---

Regimens

Identify the appropriate regimen for the patient. There are four basic regimens recommended for treating adults with TB caused by organisms that are known or presumed to be susceptible to isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), and ethambutol (EMB). Children, depending on the circumstances, may not receive EMB in the initial phase of a six-month regimen, but the regimens are otherwise identical. The preferred regimen for treating TB disease consists of an initial two-month phase of four drugs: INH, RIF, PZA, and EMB followed by a four-month continuation phase of INH and RIF.

Each regimen has an initial phase of two months, followed by a choice of several options for a continuation phase of either four or seven months. In Table 3: **Drug Regimens for Culture-Positive Pulmonary Tuberculosis Caused by Drug-Susceptible Organisms**, the initial phase is denoted by a number (1, 2, 3, or 4), and the options for

the continuation phase are denoted by the respective number and a letter designation (a, b, or c).

Directly observed therapy (DOT) is the preferred initial management strategy for all regimens and should be used whenever feasible. All patients being given drugs less than seven days per week (five, three, or two days per week) must receive DOT.

The recommended regimens, and the number of doses specified by each regimen, are described on the next page in Table 3.



For consultation regarding the treatment of TB, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Table 3: DRUG REGIMENS FOR CULTURE-POSITIVE PULMONARY TUBERCULOSIS CAUSED BY DRUG-SUSCEPTIBLE ORGANISMS²

Initial Phase			Continuation Phase			Range of total doses (minimal duration)	Rating* (evidence) [†]				
Regimen	Drugs	Interval and doses [‡] (minimal duration)	Regimen	Drugs	Interval and doses ^{‡ §} (minimal duration)		HIV-	HIV+			
1	INH RIF PZA EMB	Seven days/week for 56 doses (8 wk) or 5 d/wk for 40 doses (8 wk) [¶]	1a	INH RIF	Seven days/week for 126 doses (18 wk) or 5 d/wk for 90 doses (18 wk) [¶]	182–130 (26 wk)	A (I)	A (II)			
			1b	INH RIF	Twice weekly for 36 doses (18 wk)				92–76 (26 wk)	A (I)	A (II) [#]
			1c**	INH RPT	Once weekly for 18 doses (18 wk)				74–58 (26 wk)	B (I)	E (I)
2	INH RIF PZA EMB	Seven days/week for 14 doses (2 wk), then twice weekly for 12 doses (6 wk) or 5 d/wk for 10 doses (2 wk), [¶] then twice weekly for 12 doses (6 wk)	2a	INH RIF	Twice weekly for 36 doses (18 wk)	62–58 (26 wk)	A (II)	B (II) [#]			
			2b**	INH RPT	Once weekly for 18 doses (18 wk)				44–40 (26 wk)	B (I)	E (I)

Definitions of abbreviations: DOT = directly observed therapy; EMB = ethambutol; INH = isoniazid; HIV = human immunodeficiency virus; PZA = pyrazinamide; RIF = rifampin; RPT = rifapentine.

* Definitions of evidence ratings: A = preferred; B = acceptable alternative; C = offer when A and B cannot be given; D = should generally not be offered; E = should never be given.

† Definition of evidence ratings: I = randomized clinical trial; II = data from clinical trials that were not randomized or were conducted in other populations; III = expert opinion.

‡ When DOT is used, drugs may be given 5 days/week and the necessary number of doses adjusted accordingly. Although there are no studies that compare 5 with 7 daily doses, extensive experience indicates this would be an effective practice.

§ Patients with cavitation on initial chest radiograph and positive cultures at completion of 2 months of therapy should receive a 7-month (31 weeks; either 217 doses [daily] or 62 doses [twice weekly]) continuation phase.

¶ Five-day-a-week administration is always given by DOT. Rating for 5 day/week regimens is rated AIII.

Not recommended for HIV-infected patients with CD4+ cell counts <100 cells/microliter.

** Options 1c and 2b should be used only in HIV-negative patients who have negative sputum smears at the time of completion of 2 months of therapy and who do not have cavitation on initial chest radiograph. For patients started on this regimen and found to have a positive culture from the 2-month specimen, treatment should be extended an extra 3 months.

Initial Phase			Continuation Phase			Range of total doses (minimal duration)	Rating* (evidence)†	
Regimen	Drugs	Interval and doses‡ (minimal duration)	Regimen	Drugs	Interval and doses‡ § (minimal duration)		HIV-	HIV+
3	INH RIF PZA EMB	Three times weekly for 24 doses (8 wk)	3a	INH RIF	Three times weekly for 54 doses (18 wk)	78 (26 wk)	B (I)	B (II)
4	INH RIF EMB	Seven days/week for 56 doses (8 wk) or 5 d/wk for 40 doses (8 wk)¶	4a	INH RIF	Seven days/week for 217 doses (31 wk) or 5 d/wk for 155 doses (31 wk)¶	273–195 (39 wk)	C (I)	C (II)
			4b	INH RIF	Twice weekly for 62 doses (31 wk)	118–102 (39 wk)	C (I)	C (II)

Definitions of abbreviations: DOT = directly observed therapy; EMB = ethambutol; INH = isoniazid; HIV = human immunodeficiency virus; PZA = pyrazinamide; RIF = rifampin; RPT = rifapentine.

* Definitions of evidence ratings: A = preferred; B = acceptable alternative; C = offer when A and B cannot be given; D = should generally not be offered; E = should never be given.

† Definition of evidence ratings: I = randomized clinical trial; II = data from clinical trials that were not randomized or were conducted in other populations; III = expert opinion.

‡ When DOT is used, drugs may be given 5 days/week and the necessary number of doses adjusted accordingly. Although there are no studies that compare 5 with 7 daily doses, extensive experience indicates this would be an effective practice.

§ Patients with cavitation on initial chest radiograph and positive cultures at completion of 2 months of therapy should receive a 7-month (31 weeks; either 217 doses [daily] or 62 doses [twice weekly]) continuation phase.

¶ Five-day-a-week administration is always given by DOT. Rating for 5 day/week regimens is rated AIII.

Not recommended for HIV-infected patients with CD4+ cell counts <100 cells/microliter.

** Options 1c and 2b should be used only in HIV-negative patients who have negative sputum smears at the time of completion of 2 months of therapy and who do not have cavitation on initial chest radiograph. For patients started on this regimen and found to have a positive culture from the 2-month specimen, treatment should be extended an extra 3 months.

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):3.

Dosages



For consultation regarding the treatment of TB, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Once the appropriate regimen has been identified, refer to the following tables for instructions on dosages for each drug. First-line antituberculosis medications should be administered together; split dosing should be avoided.



For information regarding second-line drugs, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Table 4: DOSES* OF FIRST-LINE ANTITUBERCULOSIS DRUGS FOR ADULTS AND CHILDREN† 3

Drug	Preparation	Adults/children	Doses			
			Daily	1x/wk	2x/wk	3x/wk
INH	Tablets (50 mg, 100 mg, 300 mg); elixir (50 mg/5 ml); aqueous solution (100 mg/ml) for intramuscular injection¶	Adults (max.)	5 mg/kg (300 mg)	15 mg/kg (900 mg)	15 mg/kg (900 mg)	15 mg/kg (900 mg)
		Children (max.)	10–15 mg/kg (300 mg)	—	20–30 mg/kg (900 mg)	—
RIF	Capsule (150 mg, 300 mg); powder may be suspended for oral administration; aqueous solution for intravenous injection	Adults‡ (max.)	10 mg/kg (600 mg)	—	10 mg/kg (600 mg)	10 mg/kg (600 mg)
		Children (max.)	10–20 mg/kg (600 mg)	—	10–20 mg/kg (600 mg)	—

Definitions of abbreviations: EMB = ethambutol; FDA = Food and Drug Administration; INH = isoniazid; PZA = pyrazinamide; RFB = rifabutin; RIF = rifampin; RPT = rifapentine.

* Dose per weight is based on ideal body weight. Children weighing more than 40 kg should be dosed as adults.

† For the purposes of this document, adult dosing begins at the age of 15 years.

¶ INH is used, but not FDA-approved, for intravenous administration. For intravenous use of INH, please consult with your local health department and the MDCH TB Control Program at 517-335-8165.

‡ Dose may need to be adjusted when there is concomitant use of protease inhibitors or nonnucleoside reverse transcriptase inhibitors.

§ The drug can likely be used safely in older children but should be used with caution in children less than 5 years of age, in whom visual acuity cannot be monitored. In younger children, EMB at the dose of 15 mg/kg per day can be used if there is suspected or proven resistance to INH or RIF.

Drug	Preparation	Adults/children	Doses			
			Daily	1x/wk	2x/wk	3x/wk
RFB	Capsule (150 mg)	Adults [†] (max.)	5 mg/kg (300 mg)	—	5 mg/kg (300 mg)	5 mg/kg (300 mg)
		Children	Appropriate dosing for children is unknown			
RPT	Tablet (150 mg, film coated)	Adults	—	10 mg/kg (continuation phase) (600 mg)	—	—
		Children	This drug is not approved for use in children	This drug is not approved for use in children	This drug is not approved for use in children	This drug is not approved for use in children
PZA	Tablet (500 mg, scored)	Adults	See Table 5	—	See Table 5	See Table 5
		Children (max.)	15–30 mg/kg (2.0 g)	—	50 mg/kg (2.0 g)	—
EMB	Tablet (100 mg, 400 mg)	Adults	See Table 6	—	See Table 6	See Table 6
		Children [§] (max.)	15–20 mg/kg daily (1.0 g)	—	50 mg/kg (2.5 g)	—

Definitions of abbreviations: EMB = ethambutol; FDA = Food and Drug Administration; INH = isoniazid; PZA = pyrazinamide; RFB = rifabutin; RIF = rifampin; RPT = rifapentine.

* Dose per weight is based on ideal body weight. Children weighing more than 40 kg should be dosed as adults.

† For the purposes of this document, adult dosing begins at the age of 15 years.

¶ INH is used, but not FDA-approved, for intravenous administration. For intravenous use of INH, please consult with the local health department and the MDCH TB Control Program at 517-335-8165.

‡ Dose may need to be adjusted when there is concomitant use of protease inhibitors or nonnucleoside reverse transcriptase inhibitors.

§ The drug can likely be used safely in older children but should be used with caution in children less than 5 years of age, in whom visual acuity cannot be monitored. In younger children, EMB at the dose of 15 mg/kg per day can be used if there is suspected or proven resistance to INH or RIF.

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):4.

Table 5: SUGGESTED PYRAZINAMIDE DOSES, USING WHOLE TABLETS, FOR ADULTS WEIGHING 40 TO 90 KILOGRAMS⁴

Interval	Weight (kg) [*]		
	40–55 kg	56–75 kg	76–90 kg
Daily, mg (mg/kg)	1,000 (18.2–25.0)	1,500 (20.0–26.8)	2,000 † (22.2–26.3)
Thrice weekly, mg (mg/kg)	1,500 (27.3–37.5)	2,500 (33.3–44.6)	3,000 † (33.3–39.5)
Twice weekly, mg (mg/kg)	2,000 (36.4–50.0)	3,000 (40.0–53.6)	4,000 † (44.4–52.6)
<p>* Based on estimated lean body weight. † Maximum dose regardless of weight.</p>			

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):5.

Table 6: SUGGESTED ETHAMBUTOL DOSES, USING WHOLE TABLETS, FOR ADULTS WEIGHING 40 TO 90 KILOGRAMS⁵

Interval	Weight (kg) [*]		
	40–55 kg	56–75 kg	76–90 kg
Daily, mg (mg/kg)	800 (14.5–20.0)	1,200 (16.0–21.4)	1,600 † (17.8–21.1)
Thrice weekly, mg (mg/kg)	1,200 (21.8–30.0)	2,000 (26.7–35.7)	2,400 † (26.7–31.6)
Twice weekly, mg (mg/kg)	2,000 (36.4–50.0)	2,800 (37.3–50.0)	4,000 † (44.4–52.6)
<p>* Based on estimated lean body weight. † Maximum dose regardless of weight.</p>			

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):5.

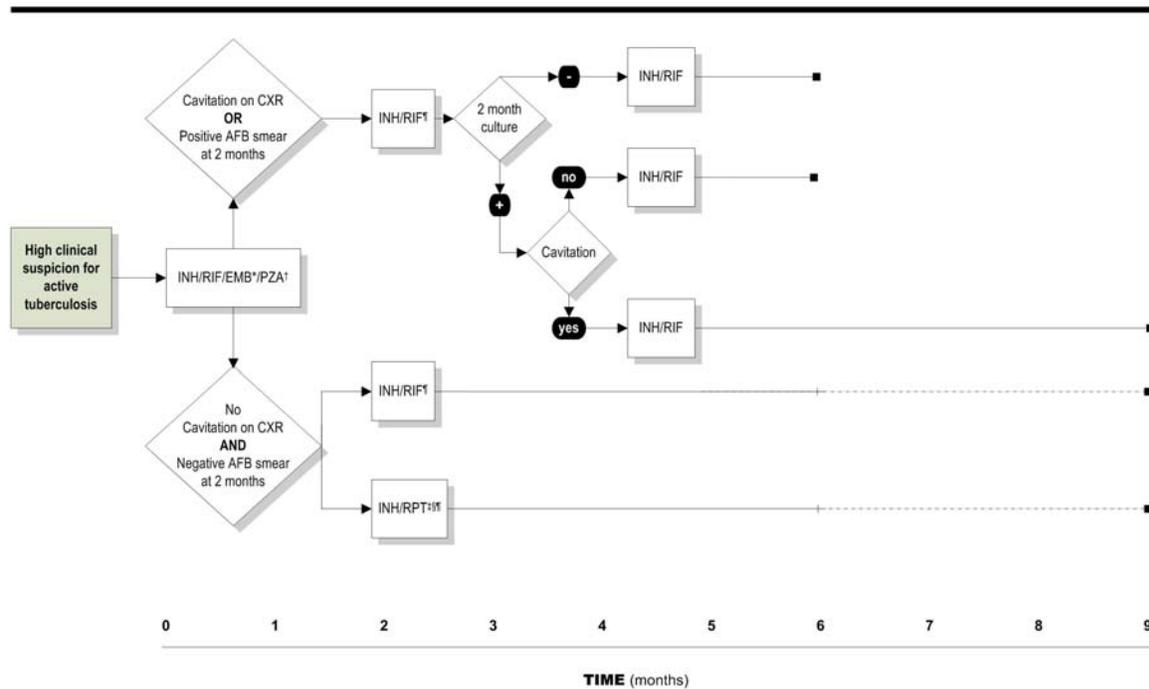
Duration of Treatment

Use the treatment algorithm in Figure 1: **Treatment Algorithm for Tuberculosis** to determine the duration of treatment. The four recommended regimens for treating patients with TB caused by drug-susceptible organisms have a duration of six to nine months. Each regimen has an initial phase of two months, followed by a continuation phase of either four or seven months.

Figure 1 gives directions for treating patients with pulmonary and extrapulmonary TB. The standard duration of treatment for pulmonary TB should be six months unless **both** cavitation is present **and** the patient is still culture positive after two months, in which case nine months is recommended. Note that there are three exceptions to the standard six-month duration of treatment.

1. For tuberculous meningitis, the optimal length of therapy has not been established, although some experts recommend nine to twelve months.⁶
2. Treatment for bone or joint TB may need to extend to nine months.⁷
3. In HIV-negative, culture-negative patients, treatment for four months may be adequate if there is clinical or radiographic improvement and no other etiology identified.⁸ However, HIV-infected patients with culture-negative pulmonary TB should be treated for a minimum of six months.⁹

Figure 1. TREATMENT ALGORITHM FOR TUBERCULOSIS¹⁰



Definition of abbreviations: AFB = acid-fast bacilli; CXR = chest radiograph; EMB = ethambutol; HIV = human immunodeficiency virus; INH = isoniazid; PZA = pyrazinamide; RIF = rifampin; RPT = rifapentine.

* EMB may be discontinued when results of drug susceptibility testing indicate no drug resistance.

† PZA may be discontinued after it has been taken for 2 months (56 doses).

‡ RPT should not be used in HIV-infected patients with TB or in patients with extrapulmonary TB.

§ Therapy should be extended to 9 months if the 2-month culture is positive.

¶ At 2 months, review drug susceptibility and culture results, if applicable, and review these results regularly throughout treatment if the patient is drug resistant.

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):6.

Side Effects and Adverse Reactions

The patient should be monitored by a registered nurse and/or clinician or case manager at least monthly for signs and symptoms of adverse reactions until treatment is completed. If a patient is symptomatic, the provider should be consulted and the patient monitored more frequently. Chemistries and complete blood count (CBC), aspartate aminotransferase (AST)/alanine aminotransferase (ALT), or other tests based on specific drugs should be done periodically as determined by the local health department and the physician in charge of the patient. See Table 8: **Monitoring and Interventions for Side Effects and Adverse Reactions** in this section.

As is true with all medications, combination chemotherapy for tuberculosis is associated with a predictable incidence of adverse effects, some mild, some serious.¹¹ Adverse effects are fairly common and often manageable. Mild adverse effects can generally be managed with symptomatic therapy; whereas with more severe effects, the offending drug or drugs must be discontinued.¹² It is vital that first-line multiple-drug therapy not be stopped without adequate justification¹³, and to recognize key adverse reactions that indicate when a drug should not be used. In addition, proper management of more serious adverse reactions often requires expert consultation.¹⁴

Monitor patients for side effects and adverse reactions following the basic monitoring steps listed below.

Basic Monitoring Steps

1. All healthcare workers providing treatment for TB disease should be familiar with the American Thoracic Society (ATS)/Centers for Disease Control and Prevention (CDC) guidelines.
 - a. All jurisdictions should follow the national monitoring guidelines identified in the current guidelines for treatment of TB, "Treatment of Tuberculosis" (*MMWR* 2003;52[No. RR-11]) at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
 - b. It is also important to check for guideline updates posted on the CDC's Division of Tuberculosis Elimination home page at <http://www.cdc.gov/tb/> and the list of guidelines by date at <http://www.cdc.gov/tb/publications/guidelines/default.htm>.
2. While on treatment, all patients should be evaluated in person at baseline (before starting treatment) and then at least monthly for side effects and adverse reactions.

3. The common side effects of and adverse reactions to drugs used to treat for TB disease are listed below in Table 7: **Reporting Reactions to Antituberculosis Medications**. Educate patients to stop the medicine and promptly report any of the symptoms or signs listed in Table 7 or any unexplained illness to the prescribing clinic immediately.
 - a. If a patient reports a potentially serious adverse reaction, call the patient's provider and the appropriate local health department immediately. For cases in which local health department jurisdiction is unclear or unknown, contact the MDCH TB Control Program at 517-335-8165.
 - b. If a patient reports a potentially less severe side effect, call the patient's provider immediately and monitor the patient.
4. If you suspect that an antituberculosis drug may be causing a particular side effect or adverse reaction:
 - a. Refer to Table 8: **Monitoring and Interventions for Side Effects and Adverse Reactions**.
 - b. Consult with the local health department and the MDCH TB Control Program at 517-335-8165.
5. If you suspect that an antituberculosis drug may be interacting with other medications that the patient is taking, refer to pages 45–47 in the "Treatment of Tuberculosis" (*MMWR* 2003;52[No. RR-11]) at <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
6. Document the following patient information:
 - a. Review of symptoms, test results, side effects, and adverse reactions
 - b. Education given
 - c. Refill provided
 - d. Description of any problems encountered and action taken for that visit
 - e. Next appointment

Reporting Reactions

The table below is intended for use by a healthcare worker who performs case management services. The healthcare worker should instruct the patient to report to the local health department and provider, the side effects and adverse reactions listed below in Table 7.

If a patient reports a potentially serious adverse reaction to a healthcare worker, the healthcare worker should call the patient's medical provider and local health department immediately. In cases where adverse reactions may prompt a change in the treatment regimen, consult with the local health department and the MDCH TB Control Program at 517-335-8165, to determine an appropriate new regimen.

If a patient reports a potentially less severe side effect to a healthcare worker, the healthcare worker should immediately call the patient's medical provider and local health department, and monitor the patient.

Table 7: REPORTING REACTIONS TO ANTITUBERCULOSIS MEDICATIONS¹⁵

Potentially Serious Adverse Reactions*	Less Severe Signs and Symptoms*
<p>Immediately report the following signs and symptoms to the patient's provider and local health department. These signs and symptoms suggest side effects, including hepatotoxicity:</p> <ul style="list-style-type: none"> ▪ Jaundice ▪ Dark urine ▪ Vomiting ▪ Abdominal pain ▪ Fever ▪ Visual changes ▪ Marked clinical rash <p>In consultation with the provider and local health department, instruct the patient to stop TB medications until further evaluation is made.</p>	<p>Report the following signs and symptoms to the patient's provider and local health department within 24 hours:</p> <ul style="list-style-type: none"> ▪ Anorexia ▪ Nausea ▪ Malaise ▪ Peripheral neuropathy: tingling or burning sensation in hands or feet ▪ Rashes
<p>* These lists are not all-inclusive. Second-line drugs are not included. For a complete list, refer to the current guidelines for treatment of TB, "Treatment of Tuberculosis" (<i>MMWR</i> 2003;52[No. RR-11]), at http://www.cdc.gov/tb/publications/guidelines/Treatment.htm.</p>	

Source: California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html>. Accessed July 11, 2006.

Monitoring for Side Effects and Adverse Reactions by Antituberculosis Drug

Refer to Table 8: **Monitoring and Interventions for Side Effects and Adverse Reactions** to do the following:

- Identify the side effects and adverse reactions associated with particular antituberculosis drugs
- Determine how to monitor for side effects and adverse reactions

Table 8: MONITORING AND INTERVENTIONS FOR SIDE EFFECTS AND ADVERSE REACTIONS^{16,17,18}

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Isoniazid (INH)	<ul style="list-style-type: none"> ▪ Rash ▪ Hepatic enzyme elevation ▪ Hepatitis ▪ Peripheral neuropathy ▪ Mild central nervous system effects 	<p>Clinical monitoring monthly</p> <p>Liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases ((human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, and pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient is pregnant, in the immediate postpartum period, or at high risk for adverse reactions ▪ Patient has symptoms of adverse reactions 	<p>Hepatitis risk increases with age and alcohol consumption.</p> <p>Pyridoxine (vitamin B6, 10–25 mg/d) might prevent peripheral neuropathy and central nervous system effects.</p> <p>Serum concentrations of phenytoin, disulfiram (Antabuse), and carbamazepine may be increased in persons taking INH. Measure serum concentrations of phenytoin and carbamazepine in patients receiving INH (with or without rifampin), and adjust the dose if necessary.</p>

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Rifampin (RIF)	<ul style="list-style-type: none"> ▪ Rash ▪ Gastrointestinal upset ▪ Hepatitis ▪ Fever ▪ Bleeding problems ▪ Thrombocytopenia ▪ Renal failure ▪ Flu-like symptoms ▪ Orange-colored body fluids (secretions, urine, tears) 	<p>Complete blood count, platelets, and liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases (human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, and pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient has symptoms of adverse reactions 	<p>There are a number of drug interactions with potentially serious consequences. Significant interactions with methadone, birth control hormones, and many other drugs.</p> <p>Contraindicated or should be used with caution when administered with protease inhibitors (PIs) and nonnucleoside reverse transcriptase inhibitors (NNRTIs). Reduces levels of many drugs (e.g., PIs, NNRTIs, methadone, dapsone, ketoconazole, coumadin derivatives, hormonal contraceptive, digitalis, sulfonyleureas, diazepam, β-blockers, anticonvulsants, and theophylline).</p> <p>For more information, refer to "Section 7: Drug Interactions" on page 45 in "Treatment of Tuberculosis" at http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf.</p> <p>Because information regarding rifamycin drug interactions is evolving rapidly, consult the CDC's Division of Tuberculosis "News and Updates" Web page at http://www.cdc.gov/tb/ to obtain the most up-to-date information.</p> <p>Colors body fluids orange.</p> <p>May permanently discolor soft contact lenses.</p>

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Rifabutin (RFB)	<ul style="list-style-type: none"> ▪ Rash ▪ Hepatitis ▪ Fever ▪ Thrombocytopenia ▪ Orange-colored body fluids (secretions, urine, tears) <p>With increased levels of RFB:</p> <ul style="list-style-type: none"> ▪ Severe arthralgias ▪ Uveitis ▪ Leukopenia 	<p>Complete blood count, platelets, and liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases (human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, and pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient has symptoms of adverse reactions <p>Use adjusted daily dose of RFB and monitor for decreased antiretroviral activity and for RFB toxicity if RFB taken concurrently with protease inhibitors (PIs) or nonnucleoside reverse transcriptase inhibitors (NNRTIs)</p>	<p>Although drug interactions are less problematic with RFB, they still occur and close monitoring is required.</p> <p>Contraindicated for HIV-infected patients taking hard-gel saquinavir or delavirdine; caution is also advised if RFB is administered with soft-gel saquinavir.</p> <p>Similar to rifampin but less potent of an inducer, rifabutin reduces levels of many drugs (e.g., PIs, NNRTIs, methadone, dapsone, ketoconazole, coumadin derivatives, hormonal contraceptive, digitalis, sulfonylureas, diazepam, β-blockers, anticonvulsants, and theophylline).</p> <p>When used with efavirenz, the daily dose of RFB should be increased from 300 mg to 450 mg or 600 mg.</p> <p>May permanently discolor soft contact lenses.</p>

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Rifapentine (RPT)	Similar to those associated with rifampin	Similar to that for rifampin	Drug interactions involving RPT are being investigated and are likely to be similar to those of rifampin. RPT is an inducer of multiple hepatic enzymes and therefore may increase metabolism of coadministered drugs that are metabolized by these enzymes. For more information, refer to "Section 7: Drug Interactions" on page 45 in "Treatment of Tuberculosis" at http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf .

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
<p>Pyrazinamide (PZA)</p>	<ul style="list-style-type: none"> ▪ Gastrointestinal upset ▪ Hepatitis ▪ Rash ▪ Photosensitive dermatitis ▪ Hyperuricemia ▪ Joint aches ▪ Gout (rare) 	<p>Clinical monitoring at weeks 2, 4, and 8</p> <p>If the drug is used in patients with underlying liver disease, laboratory and clinical monitoring should be increased</p> <p>Baseline measurements of uric acid</p> <p>Liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases (human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, or pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient has symptoms of adverse reactions 	<p>Treat hyperuricemia only if patient has symptoms.</p> <p>Might make glucose control more difficult in persons with diabetes.</p> <p>Serum uric acid measurements are not recommended as a routine but may serve as a surrogate marker for compliance.</p>

Anti-tuberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Ethambutol (EMB)	<ul style="list-style-type: none"> ▪ Optic neuritis ▪ Rash 	<p>Baseline tests of visual acuity (Snellen chart) and color discrimination (Ishihara tests)</p> <p>At each monthly visit, patients should be questioned regarding possible visual disturbances, including blurred vision or scotomata</p> <p>Monthly testing of visual acuity and color discrimination is recommended for</p> <ul style="list-style-type: none"> ▪ Patients taking doses >15–25 mg/kg ▪ Patients receiving EMB for >2 months ▪ Patients with renal insufficiency 	<p>Optic neuritis may be unilateral; check each eye separately.</p> <p>Patients should be instructed to contact their physician or public health clinic immediately if they experience a change in vision.</p> <p>EMB should be discontinued immediately and permanently if there are any signs of visual toxicity.</p>
Rifamate® (INH and RIF) Rifater® (INH, RIF, PZA)	See comments under individual drugs above		
<p>Definitions of abbreviations: ALT = alanine aminotransferase; AST = aspartate aminotransferase; EMB = ethambutol; HIV = human immunodeficiency virus; INH = isoniazid; NNRTIs = nonnucleoside reverse transcriptase inhibitors; PZA = pyrazinamide; PIs = protease inhibitors; RFB = rifabutin; RIF = rifampin; RPT = rifapentine.</p>			

Sources: CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49 (No. RR-6):26–29, 38–39; ATS, CDC, IDSA (<http://www.cdc.gov/tb/publications/guidelines/Testing.htm>). Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):19–25; CDC (<http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>). Update: Adverse event data and revised American Thoracic Society/CDC recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection—United States. *MMWR* 2003;52(No. 31):735–736; CDC (<http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>). Table 5: first-line anti-TB medications. In: Chapter 7: treatment of TB disease. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site] (http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm).

Response to Treatment



For consultation regarding a patient's response to treatment, contact the local health department or the MDCH TB Control Program at 517-335-8165.

For patients whose sputum cultures are positive before treatment, the best way to measure the effectiveness of therapy is to obtain specimens for culture at least monthly until the cultures convert to negative. Patients with multidrug-resistant tuberculosis (MDR-TB) should have cultures performed monthly for the entire course of treatment.

In some cases, a patient may not be able to produce a sputum specimen after two months of treatment. If the patient has improved clinically and has shown chest radiograph improvement, treatment may be continued as if the patient had a negative sputum specimen at two months.

Radiographic evaluations during treatment are of less importance than sputum evaluation. However, a chest radiograph at completion of treatment provides a baseline for comparison with future films.

Patients whose cultures have not become negative or whose symptoms do not resolve despite three months of therapy should be reevaluated for potential drug-resistant disease, as well as for potential failure to adhere to the regimen. If the patient is receiving self-administered therapy, the remainder of treatment should be directly observed.



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 three months, a tuberculosis (TB) medical expert should be consulted. Contact your local health department and the MDCH TB Control Program at 517-335-8165 immediately.

In patients with negative sputum cultures before treatment, the major indicators of response to therapy are the chest radiograph and clinical evaluation. The intervals at which chest radiography should be repeated depend on the clinical circumstances and the differential diagnosis that is being considered but usually should be no more than every three months. If the radiograph does not improve after the patient has received three months of treatment, the abnormality may be the result of either previous (not current) TB or another process.¹⁹

Completion of Therapy

A full course of therapy (completion of treatment) is determined more accurately if the total number of doses ingested is taken into account, as well as the duration of therapy. If there are no interruptions in drug administration, six months is usually the minimum duration of treatment and accurately indicates the amount of time in which drugs are given. However, in human immunodeficiency virus (HIV)-negative, culture-negative patients, treatment for four months may be adequate if there is clinical or radiographic improvement and no other etiology identified.²⁰

In some cases, either because of drug toxicity or nonadherence to the treatment regimen, the specified number of doses cannot be administered within the targeted period. In such cases, the goal is to deliver the specified number of doses within a recommended maximum time. For example, for a six-month daily regimen, the total doses should be administered within nine months of beginning treatment. If treatment is not completed within this period, the patient should be assessed to determine the appropriate action to take, such as continuing treatment for a longer duration or restarting treatment from the beginning.



Treating a patient for a defined duration, without accounting for the number of doses taken, can result in undertreatment.

Interruptions in treatment may have a significant effect on the duration of therapy. Reinstitution of treatment must take into account the extensiveness of the disease (e.g., cavitory versus noncavitory disease on chest radiograph, smears and cultures, immunologic status), the point in time when the interruption occurred, and the duration of the interruption. In general, the earlier in treatment an interruption occurs and the longer the duration of the interruption, the more serious the effect and the greater the need to restart therapy from the beginning.²¹



For consultation regarding completion of therapy or considerations for retreatment, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Post-Treatment Evaluation

Routine follow-up after completion of therapy is not necessary for patients with a satisfactory and prompt bacteriologic response to a six- or nine-month regimen that included both isoniazid and rifampin. However, private or hospital providers are required to report completion of treatment to the appropriate local health department.

The table below describes the clinician's responsibilities to the patient at completion of therapy for cases in which the organisms are drug-susceptible and drug-resistant.

Table 9: CLINICIAN'S RESPONSIBILITIES TO PATIENT AT COMPLETION OF THERAPY

Drug Susceptibility	Clinician's Actions
Drug-susceptible organisms	Instruct the patient to promptly report the development of any symptoms, particularly prolonged cough, fever, or weight loss.
Organisms resistant to isoniazid, rifampin, or both	Individualize follow-up evaluation. ²²



For consultation regarding post-treatment evaluation, contact the local health department or the MDCH TB Control Program at 517-335-8165.

Treatment in Special Situations

Treatment of tuberculosis (TB) in the following situations requires a high level of expertise or close consultation with an expert to provide appropriate management:

- Drug-resistant TB
- Human immunodeficiency virus (HIV) infection
- Alcoholism
- Liver disease
- Renal insufficiency and end-stage renal disease
- TB associated with tumor necrosis factor-alpha (TNF- α) antagonists
- Culture-negative pulmonary TB
- Extrapulmonary TB
- Pregnancy and breastfeeding
- TB in children



For consultation regarding treatment in any of the following situations, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Drug-Resistant Tuberculosis



Treatment of TB caused by drug-resistant organisms should be provided by, or in close consultation with, an expert in the management of these difficult situations. Second-line regimens often represent the patient's last hope for being cured, and inappropriate management can have life-threatening consequences.²³

Drug resistance is proven only by drug-susceptibility testing performed in a competent laboratory. A patient with a strain of *Mycobacterium tuberculosis* resistant to both isoniazid (INH) and rifampin (RIF) has multidrug-resistant TB (MDR-TB). Seek consultation through the MDCH TB Control Program at 517-335-8165, for treatment of a patient with resistance to any of the first-line drugs.

Acquired drug resistance usually develops when an inadequate drug regimen is prescribed (e.g., inappropriate drugs or insufficient dosage) or when there is a combined failure of both the patient and the provider to ensure that an adequate regimen is taken. A patient with acquired drug resistance may transmit his or her strain to others, who may then develop primary drug-resistant TB.²⁴

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:11-12, 68–70). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
- CDC. “Multidrug-Resistant Tuberculosis (MDR TB)” and “Extensively Drug-Resistant Tuberculosis (XDR TB)” (*TB Elimination Fact Sheets*). Available at: <http://www.cdc.gov/tb/publications/factsheets/drtb.htm>.

Human Immunodeficiency Virus Infection

Management of HIV-related TB is complex and requires expertise in the management of both HIV disease and TB. Because HIV-infected patients often take numerous medications, some of which interact with antituberculosis medications, clinicians should seek consultation through the local health department and the MDCH TB Control Program at 517-335-8165 when treating HIV-related TB.

It is especially important to use directly observed therapy (DOT) and other adherence-promoting strategies with patients with HIV-related TB. If you are unfamiliar with such resources in your area, consult with your local health department or the MDCH TB Control Program at 517-335-8165.



The following are contraindicated in HIV-infected patients:

- Isoniazid-rifapentine (INH-RPT) once weekly
- Twice-weekly rifampin (RIF)- or rifabutin (RFB)-based regimens in patients with CD4+ cell counts of less than 100 per microliter²⁵



Patients with HIV-related TB may experience a temporary exacerbation of symptoms, signs, or radiographic manifestations (paradoxical reactions) of TB while receiving antituberculosis treatment.²⁶

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:9, 50–55). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
- ATS, CDC. “Notice to Readers: Updated Guidelines for the Use of Rifamycins for the Treatment of Tuberculosis among HIV-infected Patients Taking Protease Inhibitors or Nonnucleoside Reverse Transcriptase Inhibitors” (*MMWR* 2004;53[No. 2]:37). Available at: <http://www.cdc.gov/mmwr/PDF/wk/mm5302.pdf>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site). Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

- CDC. “Treatment of Drug-Susceptible TB in HIV-Infected Persons” (*TB Elimination Fact Sheet*, March 2003). Available at <http://www.cdc.gov/tb/publications/factsheets/treatment.htm>.
- CDC. “Guidelines for the Prevention and Treatment of Opportunistic Infections Among HIV-Exposed and HIV-Infected Children” (*MMWR* 2009; 58: 1-166). Available at <http://www.cdc.gov/mmwr/pdf/rr/rr58e0826.pdf>.
- CDC. “Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Infected Adults and Adolescents” (*MMWR* 2009; 58: 1-198). Available at <http://www.cdc.gov/mmwr/pdf/rr/rr58e324.pdf>.

Alcoholism

Alcohol-Related Treatment Complications

The risks of drug-induced liver injury and nonadherence complicate health interventions for patients who are diagnosed with TB disease or latent tuberculosis infection (LTBI) and who also are known or suspected to abuse alcohol, drink heavily, or regularly consume alcohol.

In several important ways related to tuberculosis and its treatment, alcohol consumption increases health risks and can complicate the treatment of TB patients.

- **Immunosuppression:** Persons who use alcohol may be at increased risk for acquiring or developing TB, but given the many other potential risk factors that commonly occur among such persons, alcohol use has been difficult to identify as a separate risk factor for TB.²⁷ However, studies have shown that “alcohol consumption is a major risk factor for infection with opportunistic bacterial, viral, fungal, and parasitic pathogens.”²⁸
- **Liver injury and death:** Drug-induced liver injury “may occur with all currently recommended regimens for the treatment of ...LTBI”.²⁹ In the treatment of TB disease, “the crucial efficacy of isoniazid, and particularly rifampin, warrants their use and retention, if at all possible, even in the face of preexisting liver disease.”³⁰ However, it is not fully understood how antituberculosis medications cause drug-induced liver injury.³¹ For persons taking isoniazid, an association of hepatitis was found with alcohol consumption, with rates being fourfold higher among persons consuming alcohol daily than among those who did not drink alcohol.³² When a patient has hepatic disease, the risk of drug accumulation and drug-induced hepatitis is increased. However, with more frequent laboratory and clinical monitoring, isoniazid may be used in patients with stable hepatic disease. Transient asymptomatic hyperbilirubinemia may occur in patients taking rifampin or rifapentine, and more severe clinical hepatitis may also occur. Hepatitis is more common when rifampin is given with isoniazid than when rifampin is given alone or with drugs other than isoniazid.^{33,34} Pyrazinamide has slightly lower rates of hepatotoxicity than isoniazid or rifampin, but pyrazinamide can cause liver injury that may be severe and prolonged.³⁵

To prevent and manage drug-induced liver injury, the American Thoracic Society recommends the following systematic steps: consideration of benefits and risks in selecting patients and regimens, careful and thorough staff and patient education, ready access to care, good communication between providers, and clinical and biochemical monitoring.³⁶

- **Nonadherence to treatment:** Patients who do not complete LTBI treatment risk progression to TB disease, and those who do not complete treatment for TB disease risk relapse, development of drug-resistant TB, serious illness, and possible death. Barriers to adherence may be patient-related, such as conflicting health beliefs, alcohol or drug dependence, or mental illness, or they may be system-related, such as lack of transportation, inconvenient clinic hours, and lack of interpreters.³⁷ It is more difficult for patients who have an alcohol use disorder to adhere to therapy. In a prospective study of 224 patients, “noncompliance was significantly associated with homelessness and alcoholism.”³⁸ In a study of 237 patients in the Russian Federation undergoing DOTS treatment for TB disease, “substance abuse was identified as the only factor that was strongly associated with non-adherence... These results suggest that DOTS programmes [sic] might be more likely to achieve TB control targets if they include interventions aimed at improving adherence by diagnosing and treating substance abuse concurrently with standard TB therapy.”³⁹ DOTS programs that have explicitly offered substance abuse treatment have reported better outcomes than those that have not.⁴⁰ In South Carolina, joint treatment programs to treat patients with TB who have alcohol and substance abuse problems were used in conjunction with incentives, enablers, and a process of increasing restrictions (health department warnings, then court-ordered directly observed therapy, then involuntary confinement) as needed to address noncompliance. This combination of strategies was associated with an increase in overall completion of antituberculosis therapy and a decrease in new cases between 1986-1991.⁴¹

Safe Treatment Guidelines

In 2006, the American Thoracic Society (ATS) issued “An Official ATS Statement: Hepatotoxicity of Antituberculosis Therapy.” Consult these recommendations at <http://www.thoracic.org/sections/publications/statements/pages/mtpi/hepatotoxicity-antituberculosis-therapy.html> on pages 943-947 for guidance in the following areas for the safe treatment of LTBI and TB Disease:

- Program Infrastructure
- Provider Education and Resources
- Pretreatment Clinical Evaluation
- Patient Education
- Medication Administration and Pharmacy
- Treatment of LTBI and Treatment of TB Disease

Liver Disease

Management of TB in patients with unstable or advanced liver disease is difficult. The likelihood of drug-induced hepatitis may be greater in these patients. The implications of drug-induced hepatitis for patients with marginal hepatic reserve are potentially serious, even life-threatening. Also, fluctuations in the biochemical indicators of liver function (with/without symptoms) related to the preexisting liver disease confound monitoring for drug-induced hepatitis.⁴²



For all patients with preexisting liver disease, frequent clinical and laboratory monitoring should be performed to detect drug-induced hepatic injury.⁴³

Resources

- ATS, CDC, IDSA. "Treatment of Tuberculosis" (*MMWR* 2003;52[No. RR-11]:11, 65). Available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.



For consultation regarding patients with preexisting liver disease, contact the local health department or the MDCH TB Control Program at 517-335-8165.

Renal Insufficiency and End-Stage Renal Disease

Treatment Complications

Renal insufficiency complicates the management of TB because some antituberculosis medications are cleared by the kidneys. Management may be further complicated by the removal of some antituberculosis agents via hemodialysis. Thus, some alteration in dosing antituberculosis medications is commonly necessary in patients with renal insufficiency and end-stage renal disease (ESRD) receiving hemodialysis.

Creatinine Clearance

Dosing recommendations are based on patients' creatinine clearance.

Administration of drugs that are cleared by the kidneys is managed in the same manner, with an increase in dosing interval for patients having a creatinine clearance of less than 30 ml/minute or for patients receiving hemodialysis.

In patients having a reduced creatinine clearance (but not less than 30 ml/minute), standard doses should be used, but measurement of serum concentrations should be considered to avoid toxicity.⁴⁴

Dosing Recommendations

For patients having a creatinine clearance of less than 30 ml/minute or for patients receiving hemodialysis, the following adjustments to conventional dosing are recommended.

Table 10: DOSING RECOMMENDATIONS FOR ADULT PATIENTS WITH REDUCED RENAL FUNCTION AND FOR ADULT PATIENTS RECEIVING HEMODIALYSIS⁴⁵

Drug	Change in Frequency?	Recommended dose and frequency for patients with creatinine clearance <30 ml/min or for patients receiving hemodialysis
Isoniazid	No change	300 mg once daily, or 900 mg 3 times per week
Rifampin	No change	600 mg once daily, or 600 mg 3 times per week
Pyrazinamide	Yes	25–35 mg/kg per dose 3 times per week (not daily)
Ethambutol	Yes	15–25 mg/kg per dose 3 times per week (not daily)
Moxifloxacin	No	400 mg/dose daily [†]
Levofloxacin	Yes	750–1,000 mg per dose 3 times per week (not daily)
Cycloserine	Yes	250 mg once daily, or 500 mg/dose 3 times per week*
Ethionamide	No change	250-500 mg/dose daily
p-Aminosalicylic acid	No change	4 g/dose, twice daily
Streptomycin	Yes	12–15 mg/kg per dose 2 or 3 times per week (not daily)
Capreomycin	Yes	12–15 mg/kg per dose 2 or 3 times per week (not daily)
Kanamycin	Yes	12–15 mg/kg per dose 2 or 3 times per week (not daily)
Amikacin	Yes	12–15 mg/kg per dose 2 or 3 times per week (not daily)

Drug	Change in Frequency?	Recommended dose and frequency for patients with creatinine clearance <30 ml/min or for patients receiving hemodialysis
<p>* The appropriateness of 250-mg daily doses has not been established. There should be careful monitoring for evidence of neurotoxicity. (See Section 3 of the "Treatment of Tuberculosis" guidelines.)</p> <p>† No adjustment in dose is needed for those with low creatinine clearance or those on hemodialysis. No adjustment in dosing frequency is needed, but it may be given three times per week to facilitate administration.</p> <p>Standard doses are given unless there is intolerance. The medications should be given after hemodialysis on the day of hemodialysis. Monitoring of serum drug concentrations should be considered to ensure adequate drug absorption, without excessive accumulation, and to assist in avoiding toxicity.</p> <p>Data currently are not available for patients receiving peritoneal dialysis. Until data become available, begin with doses recommended for patients receiving hemodialysis and verify adequacy of dosing, using serum concentration monitoring.</p>		

Source: ATS, CDC, IDSA. Treatment of Tuberculosis. *MMWR* 2003;52(No. RR-11): 64; with information on Moxifloxacin added by Dr. Charles Daley.

- **Rifampin** and **isoniazid** are metabolized by the liver, so conventional dosing may be used in the setting of renal insufficiency.
- Supplemental dosing is not necessary for **isoniazid**, **rifampin**, or **ethambutol**. If **pyrazinamide** is given after hemodialysis, supplemental dosing is not required.
- A longer interval between doses with three times a week administration is recommended for **pyrazinamide** and **ethambutol**.
- Doses of **streptomycin**, **kanamycin**, **amikacin**, and **capreomycin** must be adjusted in patients with renal failure, and the dosing interval should be increased. In general, the dose should not be reduced because the drugs exhibit concentration dependent bactericidal action, and smaller doses may reduce drug efficacy.
- **Ethionamide** requires no dose adjustment.
- Twice daily dosing (4 g) of **p-Aminosalicylic acid (PAS)** should be adequate if the granule formulation is used. Its metabolite, acetyl-PAS, is substantially removed by hemodialysis.
- **Cycloserine** requires an increase in the dosing interval to avoid accumulation between hemodialysis sessions, and the drug should be given after hemodialysis to avoid underdosing.
- The **fluoroquinolones** undergo some degree of renal clearance that varies from drug to drug. For example, levofloxacin undergoes greater renal clearance than moxifloxacin. It should be noted that the fluoroquinolone dosing recommendations for end-stage renal disease provided by the manufacturers were developed for treating pyogenic bacterial infections. These recommendations may not be applicable to the treatment of tuberculosis in patients with end-stage renal disease.

Administration of Drugs Immediately After Hemodialysis

Administration of all antituberculosis drugs immediately after hemodialysis will facilitate DOT (three times per week) and avoid premature removal of the drugs.

Monitoring of Serum Drug Concentrations

It is important to monitor serum drug concentrations of cycloserine, ethambutol or any of the injectable agents, in persons with renal insufficiency to minimize dose-related toxicity while providing effective doses.

Clinicians also should be aware that patients with end-stage renal disease may have additional clinical conditions, such as diabetes mellitus with gastroparesis, that may affect the absorption of the antituberculosis drugs, or they may be taking concurrent medications that interact with these drugs. Under these circumstances a careful clinical and pharmacologic assessment is necessary, and, in selected cases, serum drug concentration measurements may be used to assist in determining the optimum dose of the antituberculosis drugs.

Finally, there is no data for patients receiving peritoneal dialysis. Because the drug removal mechanisms differ between hemodialysis and peritoneal dialysis, it cannot be assumed that all of the recommendations in Table 1 will apply to peritoneal dialysis. Such patients may require close monitoring, including measurements of the serum concentrations of the antituberculosis drugs.⁴⁶

Tuberculosis Associated with Tumor Necrosis Factor-Alpha Antagonists

TB is a potential consequence of treatment with tumor necrosis factor-alpha (TNF- α) antagonists such as the following:

- Infliximab (Remicade[®])
- Etanercept (Enbrel[®])
- Adalimumab (Humira[®])

These drugs work by blocking TNF- α , an inflammatory cytokine, and are approved for treating rheumatoid arthritis and other selected autoimmune diseases. Blocking TNF- α can allow a patient to progress from latent TB infection (LTBI) to TB disease. Healthcare providers should take steps to prevent TB in immunocompromised patients and remain vigilant for TB as a cause of unexplained febrile illness.⁴⁷



Patients should be screened for risk factors for *M. tuberculosis* infection and tested for infection before initiating immunosuppressive therapies, including TNF- α antagonists.⁴⁸

Resources

- CDC. “Tuberculosis Associated with Blocking Agents against Tumor Necrosis Factor-Alpha—California, 2002–2003” (*MMWR* 2004;53[No. 30]:83–686). Available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.

Culture-Negative Pulmonary Tuberculosis

A diagnosis of TB should not be ruled out if *M. tuberculosis* cannot be isolated from persons suspected of having pulmonary TB on the basis of clinical features and chest radiographic examination. Alternative diagnoses should be carefully considered and further appropriate diagnostic studies undertaken in persons with apparent culture-negative TB.⁴⁹

A diagnosis of culture-negative pulmonary TB can be made if all the following conditions are met:

- Initial acid-fast bacilli (AFB) smears and cultures are negative.
- Clinical or radiographic response occurs within two months of initiation of therapy.
- No other diagnosis has been established.⁵⁰

After the initial phase (first two months), continue treatment with an additional two months of isoniazid and rifampin during the continuation phase to complete a total of four months of treatment.⁵¹ However, HIV-infected patients with culture-negative pulmonary TB should be treated for a minimum of six months.⁵²



For consultation regarding the treatment of TB in a patient with negative cultures, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:10, 61). Available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.

Extrapulmonary Tuberculosis

The basic principles for treating pulmonary TB also apply to extrapulmonary forms of the disease. The addition of corticosteroids is recommended for patients with TB pericarditis and TB meningitis. Recommendations concerning duration of therapy are as follows:

- Use a six-month course of therapy for TB involving any site.⁵³ **Exceptions:** For bone or joint TB, use a six- to nine-month regimen.⁵⁴ For the meninges, use a nine- to twelve-month regimen.⁵⁵
- Consider prolonging therapy for patients with TB in any site that is slow to respond.⁵⁶

Note: Affected lymph nodes may enlarge while patients are receiving appropriate therapy or after treatment has ended without any evidence of bacteriologic relapse. On occasion, new nodes can appear during or after treatment as well.⁵⁷



For consultation to discuss length of treatment, contact the local health department or the MDCH TB Control Program at 517-335-8165.

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:10, 56–61). Available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site). Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

Pregnancy and Breastfeeding

Because of the risk of TB to the fetus, treatment in pregnant women should be initiated whenever the probability of maternal disease is moderate to high. The initial treatment regimen should consist of isoniazid (INH), rifampin (RIF), and ethambutol (EMB). As pyrazinamide (PZA) generally is not included in the initial treatment regimen, the minimum duration of therapy is nine months. Although these drugs cross the placenta, they do not appear to have teratogenic effects.

Breastfeeding should not be discouraged in women being treated with first-line antituberculosis agents because the small concentrations of drugs in breast milk do not produce toxicity in the nursing newborn. Conversely, drugs in breast milk should not be considered an effective treatment for TB in a nursing infant.⁵⁸

Pyridoxine supplementation (25 mg/day) is recommended for all women taking INH who are either pregnant or breastfeeding.⁵⁹

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:11, 62–63). Available at <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site). Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- American Academy of Pediatrics. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006 (Red Book® Online Web site). Available at <http://www.aapredbook.org>.

Tuberculosis in Children

A pediatric patient is defined legally as a person below the age of 18 years, but children 5 years of age or younger are the most vulnerable for rapid progression from TB infection to active disease, and the development of miliary or other severe disease manifestations.



Because of the high risk of disseminated TB in infants and children younger than five years of age, treatment should be started as soon as the diagnosis of TB is suspected.⁶⁰ When considering treatment of TB disease in a child, consult with the local health department and the MDCH TB Control Program at 517-335-8165.

The following recommendations have been developed for children:

- Regimens recommended for infants, children, and adolescents with TB are generally the same as those for adults.
Exception: Ethambutol (EMB) is not used routinely in children.⁶¹
- Duration of treatment in children is six months.
Exception: For disseminated disease and TB meningitis, use a nine- to twelve-month regimen.⁶² For other exceptions, refer to “Duration of Treatment” in the “Treatment Regimens and Dosages” topic in this section.
- Directly observed therapy (DOT) always should be used in treating children.⁶³

Due to the difficulty of isolating *M. tuberculosis* in a child with pulmonary TB, the choice of drugs for the child is frequently guided by the drug susceptibility test results of the presumed source case. If drug-resistant TB is suspected or the source case isolate is not available, specimens for microbiological evaluation should be obtained via early morning gastric aspiration, bronchoalveolar lavage, or biopsy.⁶⁴

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]:9–10, 55–56). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site). Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- Francis J. Curry National Tuberculosis Center. *Pediatric Tuberculosis: An Online Presentation* (Francis J. Curry National Tuberculosis Center Web site; 2007). Available at: http://www.nationaltbcenter.ucsf.edu/pediatric_tb/.
- American Academy of Pediatrics. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006 (Red Book® Online Web site). Available at: <http://www.aapredbook.org>.

Resources and References

Resources

- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]). Available at <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- CDC. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at <http://www.cdc.gov/tb/publications/webcourseswebinars/default.htm>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site; 1999). Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ² ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):3.
- ³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):4.
- ⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):5.
- ⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):5.
- ⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):57.
- ⁷ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):57.
- ⁸ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):6–7.
- ⁹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):52.
- ¹⁰ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):6.
- ¹¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ¹² ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ¹³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ¹⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ¹⁵ California Department of Health Services(CDHS)/California Tuberculosis Controllers Association(CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. 1998:9. Available at: <http://www.ctca.org/guidelines/index.html>.
- ¹⁶ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):26–29, 38–39.
- ¹⁷ CDC. Module 4: treatment of tuberculosis and tuberculosis infection. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:8–9, 15–17. Available at http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- ¹⁸ CDC. Update: adverse event data and revised American Thoracic Society/CDC recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection—United States. *MMWR* 2003;52(No. 31): 735–736.
- ¹⁹ CDC. Response to treatment. In: Chapter 7: treatment of TB disease. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at <http://www.cdc.gov/tb/publications/webcourseswebinars/default.htm>.
- ²⁰ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):6–7.
- ²¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):8.
- ²² CDC. Response to treatment. In: Chapter 7: treatment of TB disease. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at <http://www.cdc.gov/tb/publications/webcourseswebinars/default.htm>.
- ²³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):68–69.
- ²⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):68–69.
- ²⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):51.
- ²⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):51.
- ²⁷ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):10.

-
- ²⁸ Brudkey K, Dobkin J. Resurgent tuberculosis in New York City. *Am Rev Respir Dis* 1991;144:745-749; In: Isake, L. Introduction to the symposium. Alcoholism and tuberculosis: an overview. *Alcohol Clin Exp Res* February 1995;19(1):1-2.
- ²⁹ Saukkonen, JJ, Cohn, DL, Jasmer, RM, Schenker, S, Jereb, JA, Nolan, CM, Peloquin, CA, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006;174:937.
- ³⁰ Saukkonen, JJ, Cohn, DL, Jasmer, RM, Schenker, S, Jereb, JA, Nolan, CM, Peloquin, CA, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006;174:947.
- ³¹ Saukkonen, JJ, Cohn, DL, Jasmer, RM, Schenker, S, Jereb, JA, Nolan, CM, Peloquin, CA, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006;174:935.
- ³² CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):16-18.
- ³³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):20-21.
- ³⁴ Saukkonen, JJ, Cohn, DL, Jasmer, RM, Schenker, S, Jereb, JA, Nolan, CM, Peloquin, CA, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006;174:937.
- ³⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):24.
- ³⁶ Saukkonen, JJ, Cohn, DL, Jasmer, RM, Schenker, S, Jereb, JA, Nolan, CM, Peloquin, CA, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006;174:935.
- ³⁷ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):10.
- ³⁸ Brudkey K, Dobkin J. Resurgent tuberculosis in New York City. *Am Rev Respir Dis* 144:745-749, 1991. In: Isake, L. Introduction to the symposium. Alcoholism and tuberculosis: an overview. *Alcohol Clin Exp Res* February 1995;19(1):1-2.
- ³⁹ Gelmanova, IY, Keshavjee S, Golubchikova VT, Berezina VI, Strelis AK, Yanova GV, Atwoodr S, Murray M. Barriers to successful tuberculosis treatment in Tomsk, Russian Federation: non-adherence, default and the acquisition of multidrug resistance. *Bulletin of the World Health Organization* September 2007;85(9):647-732. Available at: <http://www.who.int/bulletin/volumes/85/9/06-038331/en/index.html>.
- ⁴⁰ Gelmanova, IY, Keshavjee S, Golubchikova VT, Berezina VI, Strelis AK, Yanova GV, Atwoodr S, Murray M. Barriers to successful tuberculosis treatment in Tomsk, Russian Federation: non-adherence, default and the acquisition of multidrug resistance. *Bulletin of the World Health Organization* September 2007;85(9):647-732. Available at: <http://www.who.int/bulletin/volumes/85/9/06-038331/en/index.html>.
- ⁴¹ CDC. Approaches to improving adherence to antituberculosis therapy – South Carolina and New York, 1986-1991. *MMWR* 1993;42(04):74-75, 81.
- ⁴² ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):65.
- ⁴³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):11.
- ⁴⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):63.
- ⁴⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):64.
- ⁴⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):64.
- ⁴⁷ CDC. Tuberculosis associated with blocking agents against tumor necrosis factor-alpha—California, 2002-2003. *MMWR* 2004;53(No. 30):683.
- ⁴⁸ CDC. Tuberculosis associated with blocking agents against tumor necrosis factor-alpha—California, 2002-2003. *MMWR* 2004;53(No. 30):685.
- ⁴⁹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):61.
- ⁵⁰ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):61.
- ⁵¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):6, 61.
- ⁵² ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):52.
- ⁵³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):10.
- ⁵⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):57.
- ⁵⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):10, 57, 58-59.
- ⁵⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):10.
- ⁵⁷ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):57.
- ⁵⁸ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):62-63.
- ⁵⁹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):11.
- ⁶⁰ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):55.
- ⁶¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):55-56.
- ⁶² ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):56.
- ⁶³ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):56.
- ⁶⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):55.

Diagnosis of Latent Tuberculosis Infection

CONTENTS

Introduction.....	7.2
Purpose.....	7.2
Policy	7.2
High-Risk Groups	7.3
Diagnosis of Latent Tuberculosis Infection	7.4
Interferon gamma release assays.....	7.4
Mantoux tuberculin skin testing	7.5
Candidates for Mantoux tuberculin skin testing.....	7.6
Administration of the tuberculin skin test	7.9
Measurement of the tuberculin skin test	7.11
Interpretation of the tuberculin skin test.....	7.12
Human immunodeficiency virus screening	7.14
Follow-up activities.....	7.14
Chest radiography.....	7.14
Resources and References	7.17

Introduction

Purpose

Use this section to understand and follow national, State of Michigan and MIACET guidelines to do the following:

- Classify patients with latent TB infection (LTBI).
- Diagnose LTBI.

In the 2005 guideline “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America,” one of the recommended strategies to achieve the goal of reduction of TB morbidity and mortality is the identification of persons with LTBI at risk for progression to TB disease, and treatment of those persons with an effective drug regimen.¹



Contacts are mentioned within this section, but their evaluation and follow-up are covered in more depth in the Contact Investigation section. For information on treatment, refer to the Treatment of Latent Tuberculosis Infection section.

Policy

- In Michigan: Targeted testing for LTBI should be conducted only among persons in groups with identified risk factors for LTBI and/or progression to TB disease.
- Contacts should be evaluated as described in the Contact Investigation section.
- Health care professionals who administer and read tuberculin skin tests (TST), shall achieve certification through the TB skin test training course as identified by MDCH.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

High-Risk Groups

Certain factors identify persons at high risk for tuberculosis (TB) infection and/or for progression to TB disease. Persons in the high-risk groups listed in Table 1: **Persons at High Risk for Tuberculosis Infection and Progression to Tuberculosis Disease** are candidates for tuberculin skin testing in Michigan. Persons with risk factors from both columns may be at much higher risk than those with risk factors in only one column. For example, an individual born in a high-TB-prevalence country with HIV infection is at much higher risk of having active TB than a US-born individual with HIV infection.

TABLE 1: Persons at high risk for Tuberculosis Infection and Progression to Tuberculosis Disease²

For Tuberculosis Infection	For Progression to Tuberculosis Disease ³
<ul style="list-style-type: none"> ▪ High-priority or close contacts of persons who have smear-positive pulmonary or laryngeal TB (e.g. housemates or coworkers w/ frequent close contact to case) ▪ Infants, children, and adolescents exposed to adults in high-risk categories ▪ Recent immigrants (<5 years) from countries with high incidence of TB ▪ Recent immigrants from Mexico ▪ Migrant workers ▪ Persons who have recently spent over 3 months in high-incidence countries ▪ Social or ethnic minority groups (e.g. African-Americans, Hispanics, Asians or Pacific Islanders, Native Americans) ▪ Persons for whom risk for TB transmission is high: <ul style="list-style-type: none"> • Homeless persons • Injection drug users • Persons living or working in institutions with individuals at risk for active TB disease such as: <ul style="list-style-type: none"> ▪ Hospitals, especially staff in nursing, emergency departments, and laboratories ▪ Long-term care facilities ▪ Homeless shelters ▪ Residences for acquired immunodeficiency syndrome (AIDS) patients ▪ Correctional facilities 	<ul style="list-style-type: none"> ▪ Persons with HIV infection ▪ Infants and children aged <5 years ▪ Persons infected with <i>Mycobacterium tuberculosis</i> within the previous 2 years ▪ Persons with a history of untreated or inadequately treated TB disease ▪ Persons with radiographic findings consistent with previous TB disease ▪ Persons who abuse alcohol or use illegal drugs (such as injection drugs or crack cocaine) ▪ Persons with any of the following clinical conditions or other immunocompromising conditions: <ul style="list-style-type: none"> • Silicosis • Diabetes mellitus • End-state renal disease (ESRD)/chronic renal failure, hemodialysis • Some hematologic disorders (e.g., leukemias and lymphomas) • Other malignancies (e.g., carcinoma of head, neck, or lung) • Body weight $\geq 10\%$ below ideal body weight • Prolonged corticosteroid use • Use of other immunosuppressive treatments (e.g., prednisone or tumor necrosis factor-alpha [TNF-α] antagonists) • Organ transplantation • Gastrectomy • Chronic malabsorption syndromes • Jejunioileal bypass

Diagnosis of Latent Tuberculosis Infection

The diagnosis of latent tuberculosis infection (LTBI) has traditionally been based upon results of tuberculin skin testing. However, the QuantiFERON[®]-TB Gold (QFT-G) test and the QuantiFERON[®]-TB Gold in-tube (QFT[™]) test, which are whole-blood interferon gamma release assays (IGRAs), are now other options for detecting LTBI.

Use the Mantoux tuberculin skin test (TST) or an IGRA to test for *Mycobacterium tuberculosis* infection. QFT-G or QFT[™] can be used in many circumstances in which the TST is used, but should not be used in addition to the TST.⁴



For information on testing methods available in Michigan, refer to the Laboratory Services section.



For a summary of the TB classification numbers, refer to the “Tuberculosis Classification System” topic in the Surveillance section.

Interferon Gamma Release Assays

Blood assay for *Mycobacterium tuberculosis* (BAMT) is a general term referring to recently developed in vitro diagnostic tests that assess for the presence of infection with *M. tuberculosis*. This term includes, but is not limited to, interferon gamma release assays (IGRAs). The latest IGRA currently approved by the Food and Drug Administration (FDA) and available on the market is the QuantiFERON[®]-TB Gold in-tube (QFT[™]) test, which replaces the QuantiFERON[®]-TB Gold (QFT-G) test. QFT-G or QFT[™] usually can be used in place of the TST.⁵ Other cytokine-based immunoassays are under development and may also become useful in the diagnosis of *M. tuberculosis* infection. Future FDA-licensed products, in combination with Centers for Disease Control and Prevention (CDC)-issued recommendations, may provide additional diagnostic alternatives.⁶

The advantages of an IGRA, compared with the TST, are that results can be obtained after a single patient visit, and that, because it is a blood test performed in a qualified laboratory, the variability associated with skin test reading can be eliminated.⁷ In addition, the QFT-G and QFT[™] tests appear to be less affected by past BCG vaccination than the TST and may eliminate the unnecessary treatment of patients with BCG-related false-positive results.⁸ However, the QFT-G and QFT[™] tests have

practical limitations that include the need to draw blood and to ensure its receipt in a qualified laboratory in time for testing. For the QFT-G test, the blood must arrive at the laboratory less than 12 hours after collection to be incubated with the test antigens, while the lymphocytes are viable.⁹ For a QFT™ test, the blood specimens are collected directly into the three blood collection tubes, shaken vigorously, and then incubated at the collection site. After incubation, blood collection tubes should be stored no longer than three days prior to centrifugation and laboratory manipulation.

Mantoux Tuberculin Skin Testing

The Mantoux method of tuberculin skin testing is also used to detect infection with *Mycobacterium tuberculosis*.

In general, it takes two to ten weeks after infection for a person to develop a delayed-type immune response to tuberculin measurable with the Mantoux tuberculin skin test (TST).¹⁰ During the test, tuberculin is injected into the skin. The immune system of most persons with tuberculosis (TB) infection will recognize the tuberculin, causing a reaction in the skin. Repeated TSTs do not produce hypersensitivity.

The size of the measured induration (a hard, dense, raised formation) and the patient's individual risk factors should determine whether TB infection is diagnosed.¹¹ Based on the sensitivity and specificity of the purified protein derivative (PPD) TST and the prevalence of TB in different groups, three cut-points have been recommended for defining a positive tuberculin reaction:

- Greater than or equal to 5 mm of induration
- Greater than or equal to 10 mm of induration
- Greater than or equal to 15 mm of induration¹²



For more information on cut-points for the TST, see the “Interpretation of the Tuberculin Skin Test” topic in this section.

Candidates for Mantoux Tuberculin Skin Testing

The Mantoux TST can be administered to all persons, including pregnant women¹³, persons who have previously been vaccinated with bacille Calmette-Guérin (BCG)¹⁴, and human immunodeficiency virus (HIV)-infected persons. However, persons with a documented prior positive TST do not need another TST, and the Mantoux TST should not be administered until four weeks after vaccination with live-virus vaccines.



If the person being tested is a contact, follow the procedures outlined in the Contact Investigation section.

Pregnancy

Tuberculin skin testing is entirely safe and reliable for pregnant women, and pregnant women at high risk for TB infection or disease should be tested. Screen pregnant women for TB infection if they have any of the following conditions:

- Symptoms suggestive of TB disease
- HIV infection
- Behavioral risk factors for HIV
- Medical conditions other than HIV infection that increase the risk for TB disease
- Close contact with a person who has pulmonary or laryngeal TB disease
- Immigration from an area of the world where incidence of TB is high

Bacille Calmette-Guérin Vaccine

BCG vaccines are live vaccines derived from a strain of *Mycobacterium bovis*. Because their effectiveness in preventing infectious forms of TB has never been demonstrated in the United States, they are not recommended as a TB control strategy in the United States, except under rare circumstances. They are, however, used commonly in other countries. A history of BCG vaccination is not a contraindication for tuberculin skin testing, nor does it influence the indications for a TST. Administer and measure TSTs in BCG-vaccinated persons in the same manner as in those with no previous BCG vaccination.

Diagnosis and treatment of LTBI should be considered for BCG-vaccinated persons with a TST reaction of equal to or greater than 10 mm induration, especially any of the following:

- Persons continually exposed to populations with a high prevalence of TB (e.g., some healthcare workers, employees and volunteers at homeless shelters, and workers at drug treatment centers)

- Persons who were born or have lived in a country with a high prevalence of TB
- Persons exposed to someone with infectious TB, particularly if that person has transmitted TB to others¹⁵

Evaluate these patients for symptoms of TB. If a patient has symptoms of TB disease, obtain chest radiography and (if the patient is coughing) collect sputum specimens.

Bacille Calmette-Guérin Talking Points

1. Tuberculin reactivity caused by BCG vaccination wanes with time but can be boosted with a TST.¹⁶
2. A diagnosis of *M. tuberculosis* infection should be considered for any BCG-vaccinated person who has TST reaction ≥ 10 mm of induration.¹⁷
3. Treatment for LTBI should be considered for a person who is TST positive and has previous BCG vaccination if the person is:
 - A contact of a person with infectious TB or
 - Vaccinated and born in (or resided in) a country of high prevalence of TB or
 - Exposed to persons at risk for TB¹⁸
4. BCG vaccination should be considered for infants and children who reside in high morbidity countries to prevent meningial TB.¹⁹
5. There is no scientific evidence of protective ability of BCG for preventing pulmonary TB in adolescents or adults.²⁰

Anergy Testing

Anergy testing is not routinely recommended in conjunction with TST for HIV-infected persons in the United States.²¹

Anergy testing is a diagnostic procedure used to obtain information about the competence of the cellular immune system. Conditions that cause an impaired cellular immune system include HIV infection, severe or febrile illness, measles or other viral infections, Hodgkin's disease, sarcoidosis, live-virus vaccination, and corticosteroid or immunosuppressive therapy. Persons with conditions such as these may have suppressed reactions to a TST even if infected with TB. However, there are no simple skin testing protocols that can reliably identify persons as either anergic or nonanergic and that have been proven to be feasible for application in public health TB screening programs.

Factors limiting the usefulness of anergy skin testing include the following:

- Problems with standardization and reproducibility
- Low risk for TB associated with a diagnosis of anergy
- Lack of apparent benefit of treatment for LTBI in groups of anergic HIV-infected persons

Documented Prior Positive Tuberculin Skin Test

Persons who have tested positive in the past and can provide documentation of their status should not have another TST. Instead, they should have a TB symptom assessment questionnaire administered to identify any symptoms of TB disease.²² Persons who are symptomatic should receive a chest radiograph.

Live-Virus Vaccines

The Mantoux TST can be administered in conjunction with all vaccines. However, the measles (MMR) vaccine—and possibly mumps, rubella, varicella, and live attenuated influenza vaccines—may transiently suppress the response to PPD.²³ Therefore, if a vaccine containing live virus (e.g., measles, smallpox) has already been given, the TST should be deferred until (or repeated) at least four weeks after the vaccine was administered.

When giving the TST and the MMR, one of the following three sequences should be used:

- Apply the TST at same visit as the MMR.
- Delay the TST at least four weeks if the MMR is given first.
- Apply the TST first and then give the MMR when the TST is measured.²⁴

Multiple Puncture Tests

Multiple puncture tests (MPTs), such as the Tine test, should not be used. The MPTs are not reliable because the amount of tuberculin injected intradermally cannot be precisely controlled and there is no standard for interpretation.

Administration of the Tuberculin Skin Test

The TST should be placed by a healthcare worker who has received appropriate training and is following written protocols.

Table 2: BEFORE YOU BEGIN TO ADMINISTER A TUBERCULIN SKIN TEST

Before You Begin to Administer a Tuberculin Skin Test	
Review Information	<p>CDC. <i>Mantoux Tuberculin Skin Test Facilitator Guide</i>: http://www.cdc.gov/tb/education/Mantoux/guide.htm</p> <p>Infection control procedures (including hand washing before and after the procedure and the use of gloves and a sharps container) as described in CDC's Hospital Infection Control Practice Advisory Committee (HICPAC) report, available online at: http://www.cdc.gov/handhygiene.</p>
Gather Equipment	<ul style="list-style-type: none"> ▪ Gloves ▪ Alcohol pads or alternative skin cleanser ▪ Safety needle ▪ Tuberculin syringe (Do not pre-draw tuberculin into syringes prior to test.) ▪ Purified protein derivative (PPD) (Tubersol® or Aplisol®: See the warning in the text below in this table.) ▪ Sharps container <p>Note: Date PPD tuberculin vials when opened and discard them after 30 days. See the package insert for appropriate storage information.</p>



Read the PPD labels carefully before administering a TST. The packaging of tetanus toxoid-containing vaccines (TTCVs) is similar to Tubersol® and Aplisol®, and all are refrigerated. See the CDC's "Errors Involving Mix-up of Tuberculin Purified Protein Derivative and Vaccine Products" (*TB Notes Newsletter*. 2005;No. 1) at this hyperlink: http://www.tbchicago.org/tbquidecdc/newsletters/notes/TBN_1_05/Errors_mix_up.htm

How to Administer a Tuberculin Skin Test

1. Obtain the patient's written consent, if required by your health department.
2. Inject air into the vial air space (not into the solution). Injection of air into the air space in the vial prevents creation of negative pressure within the vial, allowing the antigen to be withdrawn easily. Injecting air into the solution creates bubbles and may interfere with withdrawing the correct amount of antigen.²⁵
3. The injection should be placed on the palm-side-up surface of the forearm, about two to four inches below the elbow. Your local institutional policy may specify the right or left forearm for the skin test. The area selected should be free of any barriers to placing and reading the skin test, such as muscle margins, heavy hair, veins, sores, tattoos, or scars.
4. After choosing the injection site, clean the area with an alcohol swab by circling from the center of the site outward. Allow the site to dry completely before the injection.
5. Using a disposable tuberculin safety needle and syringe, inject 0.1 ml of PPD tuberculin containing 5 tuberculin units (TU) intradermally with the needle bevel facing upward. Because some of the tuberculin solution can adhere to the inside of the plastic syringe, the skin test should be given as soon as possible after the syringe is filled.
6. The injection should produce a discrete, pale elevation of the skin (a wheal) 6 to 10 mm in diameter. **Note:** If a 6- to 10-mm wheal is not produced, repeat the test on the opposite arm or the same arm, 2 inches from the original site.
7. Record the date and time of TST administration, location of injection site, dose, name of the person who administered the test; the name and manufacturer of the tuberculin product used, its lot number, its expiration date; and the reason for testing.²⁶

Measurement of the Tuberculin Skin Test

A trained healthcare worker should read the TST 48 to 72 hours after the intradermal injection. Patients should never be allowed to read their own TSTs.²⁷

- A positive reaction can be measured anytime after 48 hours.
- If the results appear negative and more than 72 hours have passed, the test should be repeated. It can be repeated immediately, or after one week, if two-step testing is required.



See the topic titled “Two-Step Tuberculin Skin Testing” in the Infection Control section.



Before you measure a TST, review information in the CDC’s *Mantoux Tuberculin Skin Test Facilitator Guide* at this hyperlink:

<http://www.cdc.gov/tb/education/Mantoux/guide.htm> .

How to Measure a Tuberculin Skin Test

1. Measure the TST site perpendicular to the axis of the forearm (from the thumb side of the arm to the little finger side of the arm or vice versa).
2. Induration is a hard, dense, raised formation. Measure only induration hardness and not swelling around the site of the injection. Do **not** measure erythema (redness). A TST with erythema, but no induration, is nonreactive.
3. Record the test result in mm, not as “positive” or “negative.” An exact reading in mm may be necessary to interpret whether conversions occur on a subsequent test. Record a TST with no induration as “0 mm.” Where there is induration, do not round off the reading, but record it exactly as read.
4. Report adverse reactions to a TST (e.g., blistering, ulcerations, necrosis) to the FDA’s MedWatch Program at 1-800-FDA-1088, or via the Internet at this hyperlink: <http://www.fda.gov/medwatch/>.

Interpretation of the Tuberculin Skin Test

TSTs should be interpreted by a trained healthcare worker. Use Table 3 below to interpret TSTs.



Call the MDCH TB Control Program at 517-335-8165 regarding TST reactions when interpretation and medical follow-up are unclear.



Before you interpret a TST, review information in the CDC's *Mantoux Tuberculin Skin Test Facilitator Guide* at this hyperlink: <http://www.cdc.gov/tb/education/Mantoux/guide.htm> .

How to Interpret a Tuberculin Skin Test

Use the table below to determine when a reaction is positive.

Table 3: POSITIVE TUBERCULIN SKIN TEST REACTIONS

Induration Size	Considered Positive For:
5 mm or more	<ul style="list-style-type: none"> ▪ Persons with human immunodeficiency virus (HIV) infection or acquired immunodeficiency syndrome (AIDS) ▪ Recent contacts to an infectious case of tuberculosis (TB) disease ▪ Persons with fibrotic lesions on chest radiograph consistent with healed TB ▪ Persons with organ transplants or other immunosuppressed persons (such as those receiving the equivalent of >15 mg/day of prednisone for >1 month) ▪ Persons receiving treatment with tumor necrosis factor-alpha (TNF-α) antagonists
10 mm or more	<ul style="list-style-type: none"> ▪ Foreign-born persons recently arrived (within 5 years) from countries with a high TB incidence or prevalence (e.g., most countries in Africa, Asia, Latin America, Eastern Europe, the former USSR, or from refugee camps) ▪ Injection drug or other substance abusers; alcoholics ▪ Residents and employees in high-risk, congregate settings (e.g., correctional institutions; long-term residential care facilities; hospitals and other healthcare facilities; homeless shelters; and refugee camps) ▪ Mycobacteriology laboratory personnel ▪ Persons with other medical conditions that increase the risk of TB disease ▪ Children younger than 5 years of age, or children and adolescents exposed to adults in high-risk categories
15 mm or more	<ul style="list-style-type: none"> ▪ Persons with no known risk factors for TB

When interpreting TST results, be aware of the following.

Skin test conversions: For persons previously skin tested, an increase in induration of 10 mm or more within a two-year period is classified as a conversion to positive.

False-negative reactions may be due to the following:

- Anergy



See “Anergy Testing” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

- Recent TB infection (within the past 10 weeks)
- Very young age (less than six months of age, because the immune system is not fully developed)
- Overwhelming TB disease
- Vaccination with live viruses (e.g. measles, mumps, rubella, varicella, oral polio or yellow fever)



TB skin testing should be done either on the same day as vaccination with live virus or at least four weeks after vaccination.



See “Live-Virus Vaccines” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

- Some viral infections (measles, mumps, chickenpox, or HIV)
- Corticosteroids or other immunosuppressive agents given for two or more weeks

False-positive reactions may be due to the following:²⁸

- Nontuberculous mycobacteria (NTM) or mycobacterium other than tuberculosis (MOTT)
- BCG vaccination



See “Bacille Calmette-Guérin Vaccine” under “Candidates for Mantoux Tuberculin Skin Testing” in this section.

Human Immunodeficiency Virus Screening

The Centers for Disease Control and Prevention (CDC) recommends the following:

- Routine HIV screening for all patients ages 13–64 seeking health care for any reason, without regard to patient’s known risks for HIV infection
- Annual HIV screening of patients known to be at high risk²⁹

Follow-Up Activities

After testing, complete the following tasks:



If the person has signs or symptoms of TB, evaluate for TB disease as described in the “Diagnosis of Tuberculosis Disease” topic in the Diagnosis of Tuberculosis Disease section. Refer to Table 1: **When to Suspect Pulmonary Tuberculosis in Adults**.



If the person is a contact, follow the procedures for testing and evaluation in the Contact Investigation section.



If the person is a participant in two-step screening, see the topic titled “Two-Step Tuberculin Skin Testing” in the Infection Control section.



If the TST result is positive, a chest radiograph should be obtained for the patient, as specified in the “Chest Radiography” topic in this section.

Chest Radiography

All individuals being considered for LTBI treatment should undergo a chest radiograph to rule out pulmonary TB disease. For information on how to classify TB, see the “Tuberculosis Classification System” topic at the beginning of this section. Refer to Table 4 below to determine when to obtain a chest radiograph and what follow-up is required for chest radiograph results.

A posterior-anterior radiograph of the chest is the standard view used for the detection and description of chest abnormalities in adults. In some instances, other views (e.g., lateral, lordotic) or additional studies (e.g., computed tomography [CT] scans) may be necessary.



Children younger than five years of age should receive posterior-anterior and lateral radiographs.³⁰



For more information on chest radiography, refer to the Francis J. Curry National Tuberculosis Center's *Radiographic Manifestations of Tuberculosis: A Primer for Clinicians* (Francis J. Curry National Tuberculosis Center Web site; 2006) at this hyperlink:
http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-04.



For persons recently exposed to TB, follow the procedures for testing and evaluation in the Contact Investigation section.

Table 4: TARGETED TESTING FOR LATENT TUBERCULOSIS INFECTION: WHEN CHEST RADIOGRAPHS ARE REQUIRED AND HOW TO FOLLOW UP ON RADIOGRAPHY RESULTS

Signs or Symptoms of TB Disease?	TST or IGRA Result?	Recent Exposure to Infectious TB?	Chest Radiograph: Required and Results?	Follow-up Action
Yes	Positive or negative	Yes or no	CXR Required: Yes Results: normal or abnormal	<ul style="list-style-type: none"> Classify as Class 5. Evaluate for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
No	Negative	No	CXR not recommended unless the patient has HIV infection or other forms of immunosuppression are present	<ul style="list-style-type: none"> Classify as Class 0.
No	Positive	No	CXR Required: Yes Results: normal	<ul style="list-style-type: none"> Classify as Class 2. Consider treatment for LTBI. Refer to the Treatment of Latent Tuberculosis Infection section.
			CXR Required: Yes Results: abnormal noncalcified fibrotic lesions suggestive of old, healed TB; comparison film available and stable	<ul style="list-style-type: none"> Classify as Class 4 or 5. Consider evaluating for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
			CXR Required: Yes Results: abnormal consistent with TB disease; no comparison film	<ul style="list-style-type: none"> Classify as Class 3 or 5. Evaluate for TB disease. Refer to the Diagnosis of Tuberculosis Disease section.
Definitions of abbreviations: CXR = chest radiograph; HIV = human immunodeficiency virus; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test.				

Resources and References

Resources

- ATS, CDC, IDSA. “Diagnostic Standards and Classification of Tuberculosis in Adults and Children” (*Am J Respir Crit Care Med* 2000;161[4 Pt 1]). Available at: <http://www.thoracic.org/sections/publications/statements/pages/archive/tbadult1-20.html> .
- CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. November 2001. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm .
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm .

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ² CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):4–5; CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):7–9, 22.
- ³ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):8-9.
- ⁴ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54 (No. RR-15):52.
- ⁵ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):52.
- ⁶ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):4.
- ⁷ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No RR-15):52.
- ⁸ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No RR-15):50.
- ⁹ CDC. Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No RR-15):52.
- ¹⁰ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):11; CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):13; County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition:2-1*. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf> . Accessed February 6, 2007.
- ¹¹ Francis J. Curry National Tuberculosis Center. *Diagnosis and treatment* [Web page]. Available online at: http://www.nationaltbcenter.ucsf.edu/abouttb/diagnosis_and_treatment.cfm . Accessed November 30, 2006.
- ¹² CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):1–2.
- ¹³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):49.
- ¹⁴ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):50.
- ¹⁵ CDC. Candidates for treatment of latent TB infection. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ¹⁶ Sepulveda RL, Ferrer X, Latrach C, Sorensen, RU. The influence of Calmette-Guérin Bacillus immunization on the booster effect of tuberculin testing in healthy young adults. *Am Rev Respir Dis* 1990;142:24–28.

-
- ¹⁷ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/Chapter9/Tableofcontents.htm> . Accessed January 20, 2007.
- ¹⁸ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/Chapter9/Tableofcontents.htm> . Accessed January 20, 2007.
- ¹⁹ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49[No. RR-6]:11.
- ²⁰ CDC. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: http://www.cdc.gov/nchstp/tb/pubs/corecurr/Chapter9/Chapter_9_ Interpretation.htm . Accessed January 20, 2007; Smith PG. Case-control studies of the efficacy of BCG against tuberculosis. In: International Union Against Tuberculosis, ed. *Proceedings of the XXVIth IUATLD World Conference on Tuberculosis and Respiratory Diseases*. Singapore: Professional Postgraduate Services International 1987:73–9.
- ²¹ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed July 3, 2006.
- ²² CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):53.
- ²³ CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S., eds. 9th ed. Washington, DC: Public Health Foundation; 2006:24–25, 143.
- ²⁴ CDC. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S., eds. 9th ed. Washington, DC: Public Health Foundation; 2006:24–25, 143.
- ²⁵ CDC National Center for Health Statistics. Skin test preparation steps: filling syringes. In: Skin Test Preparation Steps: Filling Syringes. *National Health and Nutrition Examination Survey (NHANES) Manual*. Hyattsville, MD: National Center for Health Statistics.
- ²⁶ CDC. Part two: reading the Mantoux tuberculin skin test. *Mantoux Tuberculin Skin Test Facilitator Guide* [Division of Tuberculosis Elimination Web site]. Available online at: <http://www.cdc.gov/tb/pubs/Mantoux/part2.htm> . Accessed November 30, 2006. *Manual* 2004:1.3.
- ²⁷ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed February 6, 2007.
- ²⁸ CDC. Tuberculin skin testing. In: Chapter 4: testing for TB disease and infection. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/default.htm> . Accessed February 6, 2007.
- ²⁹ CDC. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *MMWR* 2006;55(No. RR-14):1–17.
- ³⁰ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):25.

Treatment of Latent Tuberculosis Infection

CONTENTS

Introduction.....	8.2
Purpose.....	8.2
Policy	8.3
Whom to Treat.....	8.4
Susceptible and vulnerable contacts	8.4
Tuberculin skin test results of 5 mm or more	8.5
Tuberculin skin test results of 10 mm or more	8.6
Tuberculin skin test results of 15 mm or more	8.6
Treatment Regimens and Dosages.....	8.7
Regimens.....	8.8
Dosages.....	8.9
Side Effects and Adverse Reactions	8.10
Basic monitoring steps.....	8.10
Reporting reactions.....	8.11
Monitoring for side effects and adverse reactions by antituberculosis drug	8.13
Adherence	8.16
Monthly assessment of adherence	8.16
Directly observed therapy	8.17
Completion of Therapy	8.18
Treatment in Special Situations	8.20
Human immunodeficiency virus and latent tuberculosis infection.....	8.20
Alcoholism.....	8.21
Pregnancy and breastfeeding	8.21
Resources and References	8.22

Introduction

Purpose

Use this section to understand and follow national, State of Michigan and MIACET guidelines to do the following:

- Determine whom to treat for latent tuberculosis infection (LTBI).
- Select appropriate treatment regimens and dosages.
- Monitor patients for adverse reactions.
- Monitor patients' adherence to treatment.
- Determine whether and when therapy is completed.
- Provide treatment in special situations, such as when a patient is pregnant or has tuberculosis (TB)-human immunodeficiency virus (HIV) coinfection.

Prevention of TB has major public health implications, so it is essential to identify and treat all those with risk factors for TB disease.¹ LTBI is the presence of *Mycobacterium tuberculosis* organisms (tubercle bacilli), with no symptoms and no radiographic or bacteriologic evidence of TB disease.² A person with LTBI is noninfectious but is at risk to develop active TB disease. Persons with increased risk for developing TB include those who have had recent infection with *M. tuberculosis* and those who have clinical conditions associated with an increased risk for the progression of LTBI to TB disease.

Treatment of LTBI is essential to controlling and eliminating TB in the United States. To control and prevent TB, our healthcare resources and efforts should be directed to meet the priorities outlined in the 2005 “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America.” One of the recommended strategies to achieve the goal of reduction of TB morbidity and mortality is the identification and treatment of persons with LTBI at risk for progression to TB.³

Healthcare providers must communicate the risks and benefits of treatment to their patients and encourage adherence and treatment completion. LTBI treatment substantially reduces the risk that TB infection will progress to disease: depending upon adherence and length of treatment, completing treatment for LTBI can reduce the risk of TB disease by 65–90%.^{4,5}

Policy

Treatment should be considered for all persons who are determined to be candidates for the treatment of LTBI.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

The powers and duties of local health departments relating to LTBI are covered in Section 333.5117 of the Michigan Compiled Laws. MIACET and the MDCH TB Control Program urge local health departments to assure that all persons with LTBI, or who are contacts to active cases, are appropriately evaluated and given options for treatment.

Whom to Treat

Determine whom to treat for latent tuberculosis infection (LTBI). Treatment of latent tuberculosis infection (LTBI) is an essential part of the strategy to eliminate tuberculosis (TB) in the United States. Persons with LTBI who are considered at increased risk for TB should be offered treatment.⁶ Certain groups are at high risk of developing tuberculosis (TB) disease once infected, so make every effort to begin appropriate treatment and to ensure those persons complete the entire course of treatment for LTBI.⁷



For a list of high-risk groups by tuberculin skin test (TST) results, see the Tuberculin Skin Test Results listings below. For more information on targeted testing, see the Targeted Testing for Latent Tuberculosis Infection section.



High-risk contacts (under five years of age or immunocompromised) should be started promptly on treatment for LTBI. For more information on time frames, see the “Time Frames for Contact Investigation” topic in the Contact Investigation section.

Several treatment regimens are available for the treatment of LTBI, and providers should discuss treatment options with their patients.⁸



For more information on treatment of LTBI, see the “Treatment Regimens and Dosages” topic in this section and the Centers for Disease Control and Prevention (CDC) publication “Treatment of Latent Tuberculosis Infection (LTBI)” (*TB Elimination Fact Sheet*; July, 2007) at this hyperlink: <http://www.cdc.gov/tb/publications/factsheets/treatment.htm>.



For consultation regarding the treatment of LTBI, contact the local health department of the MDCH TB Control Program at 517-335-8165.

Susceptible and Vulnerable Contacts

A contact is someone who has been exposed to *M. tuberculosis* infection by sharing air space with a person with infectious TB.⁹ Susceptible contacts are those who are more likely to become ill with TB disease if they are infected, and vulnerable contacts are those who could suffer severe morbidity if they progress to TB disease.¹⁰ Persons who are susceptible and/or vulnerable to TB disease are candidates for window period treatment, which is administering treatment for presumptive TB infection during the interval between infection and detectable skin test reactivity or positive blood testing (interferon gamma release assay [IGRA] such as the QuantiFERON[®]-TB Gold test). The

National Tuberculosis Controllers Association (NTCA) and the CDC recommend that the window period be estimated at eight to ten weeks.¹¹

The following contacts with initially negative TST or IGRA results should receive treatment for LTBI after TB disease has been ruled out by clinical examination and chest radiograph:

1. Contacts younger than five years of age (with highest priority given to those under three years)
2. Contacts with human immunodeficiency virus (HIV) infection or who are otherwise immunocompromised

If the second skin test or IGRA result is negative, and the contact is immunocompetent (including immunocompetent young children) and no longer exposed to infectious TB, treatment for LTBI may be discontinued, and further follow-up is unnecessary. If the second test is negative, but the contact is immunocompromised (e.g., with human immunodeficiency virus [HIV] infection), a course of therapy for LTBI should be completed.

If the second test result is negative, but the person remains in close contact with an infectious patient, treatment for LTBI should be continued for contacts in the following age ranges or with the following medical conditions:

1. Contacts younger than five years old
2. Contacts aged five to fifteen years, at the clinician's discretion
3. Contacts who are HIV-seropositive or otherwise immunocompromised¹²



Persons known to be (or suspected of being) immunocompromised, such as HIV-infected persons, should be given treatment for LTBI regardless of the TST or IGRA reaction.¹³

Tuberculin Skin Test Results of 5 mm or More

Persons in the following high-risk groups are candidates for treatment of LTBI if their skin test result is 5 mm or more:

- Persons with HIV infection
- Recent contacts of persons with newly diagnosed infectious TB
- Persons with fibrotic changes on their chest radiographs that are consistent with old TB
- Persons with organ transplants and other immunosuppressed patients (receiving the equivalent of 15 mg or more/day of prednisone for at least one month)¹⁴

Tuberculin Skin Test Results of 10 mm or More

Persons in the following high-risk groups are candidates for treatment of LTBI if their skin test result is greater than or equal to 10 mm:

- Foreign-born persons who have recently arrived (within five years) from countries with a high TB incidence or prevalence, or persons who have recently traveled to these countries (most countries in Africa, Asia, Latin America, Eastern Europe, and the former USSR)
- Persons who are alcoholics, who inject drugs, or who use other high-risk substances, such as crack cocaine
- Residents and employees of high-risk congregate settings, such as correctional institutions, homeless shelters, long-term residential care facilities (e.g., nursing homes, mental institutions), hospitals, and other healthcare facilities
- Mycobacteriology laboratory personnel
- Persons with medical conditions or undergoing treatments that increase the risk of TB disease (diabetes mellitus, silicosis, recent infection with *M. tuberculosis* within the past two years, bone marrow and organ transplant recipients, prolonged high-dose corticosteroid therapy and other immunosuppressive therapy, chronic renal failure, hemodialysis, some hematological disorders [e.g., leukemias and Hodgkin's disease], other specific malignancies [e.g., carcinoma of the head, neck, or lung], chronic malabsorption syndromes, weight of 10% or more below ideal body weight, and intestinal bypass or gastrectomy)
- Children less than five years of age and adolescents exposed to adults at high risk for developing TB disease¹⁵

Tuberculin Skin Test Results of 15 mm or More¹⁶

Persons in the following groups may be considered for treatment of LTBI if their skin test result is greater than or equal to 15 mm. These groups should be given a lower priority for prevention efforts than the groups already listed above.

- Persons with no known risk factors for TB disease
- Healthcare workers* who are otherwise at low risk for TB disease and who received baseline testing at the beginning of employment as part of a TB screening program¹⁷

* For healthcare workers (HCWs) who are otherwise at low risk for LTBI and progression to TB disease if infected and who received baseline testing at the beginning of employment as part of a TB infection-control screening program, a TST result of ≥ 15 mm (instead of ≥ 10 mm) is considered to be positive. Although a result of ≥ 10 mm on baseline or follow-up testing is considered a positive result for HCWs for the purposes of referral for medical and diagnostic evaluation, if the TST result is 10–14 mm on baseline or follow-up testing, the referring clinician might not recommend treatment of LTBI.¹⁸

Treatment Regimens and Dosages

Select appropriate treatment durations, regimens, and dosages. There are several treatment regimens available for the treatment of LTBI, and providers should discuss options with patients. Persons who are at especially high risk for TB, and either are suspected of nonadherence or are on an intermittent dosing regimen, should be treated using directly observed therapy (DOT). This method of treatment is especially appropriate when a household member is on DOT for TB disease or in institutions and facilities where a staff member can observe treatment.



For a list of high-risk groups, see the “Whom to Treat” topic in this section.



High-risk contacts (under five years of age or immunocompromised) should be started promptly on treatment for LTBI. For more information on time frames, see the “Time Frames for Contact Investigation” topic in the Contact Investigation section.

Regimens

Identify an appropriate regimen for the patient using the national guidelines provided in Table 1 below.

Table 1: RECOMMENDED DRUG REGIMENS FOR TREATMENT OF LATENT TUBERCULOSIS INFECTION IN ADULTS¹⁹

Drug	Interval and Duration	Comments	Rating* (evidence) [†]	
			HIV-	HIV+
INH	Daily for 9 months ^{‡ §}	In HIV-infected patients, INH may be administered concurrently with nucleoside reverse transcriptase inhibitors (NRTIs), protease inhibitors, or non-nucleoside reverse transcriptase inhibitors (NNRTIs).	A (II)	A (II)
	Twice weekly for 9 months ^{‡ §}	DOT must be used with twice-weekly dosing.	B (II)	B (II)
INH	Daily for 6 months [§]	This duration of therapy is not indicated for HIV-infected persons, those with fibrotic lesions on chest radiographs, or children.	B (I)	C (I)
	Twice weekly for 6 months [§]	DOT must be used with twice-weekly dosing.	B (II)	C (I)
RIF	Daily for 4 months in adults	RIF is used for persons who are contacts of patients with INH-resistant, RIF-susceptible TB. Some antiretroviral drugs, such as the protease inhibitors and NNRTIs, have interactions with the rifamycins. Clinicians should consult Web-based updates or experts for the latest specific recommendations.	B (II)	B (III)
	Daily for 6 months in children	The optimal length of RIF therapy in children with LTBI is not known; however, the American Academy of Pediatrics recommends 6 months of treatment. ²⁰		
<p>Definitions of abbreviations: DOT = directly observed therapy; HIV = human immunodeficiency virus; INH = isoniazid; LTBI = latent tuberculosis infection; RIF = rifampin.</p> <p>* Strength of recommendation: A = preferred; B = acceptable alternative; C = offer when A and B cannot be given.</p> <p>† Quality of evidence: I = randomized clinical trial data; II = data from clinical trials that are not randomized or were conducted in other populations; III = expert opinion.</p> <p>‡ Recommended regimen for children <18 years of age.</p> <p>§ Recommended regimen for pregnant women.</p>				

Source: CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):31.



The regimen of rifampin (RIF) and pyrazinamide (PZA) for two months is no longer recommended for treatment of LTBI because of its association with severe liver injury. For more information, see the CDC's "Update: Adverse Event Data and Revised American Thoracic Society (ATS)/Centers for Disease Control and Prevention (CDC) Recommendations Against the Use of Rifampin and Pyrazinamide for Treatment of Latent Tuberculosis Infection" (*MMWR* 2003;52[No. 31]:735) at this hyperlink: <http://www.cdc.gov/mmwr/PDF/wk/mm5231.pdf>.

Dosages

Once the appropriate regimen has been identified, refer to Table 2 for instructions on dosages for each drug. The information in Table 2 is taken from ATS, CDC, and Infectious Diseases Society of America (IDSA) guidelines.

Table 2: RECOMMENDED DOSAGES^{21,22}

Drug	Preparation	Adults/ Children	Daily	Twice a Week
INH	Tablets (50 mg, 100 mg, 300 mg); elixir (50 mg/5 ml)	Adults (max.)	5 mg/kg (300 mg)	15 mg/kg (900 mg)
		Children (max.)	10–15 mg/kg (300 mg)	20–30 mg/kg (900 mg)
RIF	Capsule (150 mg, 300 mg); powder may be suspended for oral administration	Adults (max.)	10 mg/kg (600 mg)	10 mg/kg (600 mg)
		Children (max.)	10–20 mg/kg (600 mg)	10–20 mg/kg (600 mg)

Definitions of abbreviations: INH = isoniazid; RIF = rifampin.

Source: ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):4; CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):28–29.



The use of INH elixir is discouraged, as it commonly causes diarrhea and cramping in children. If children have difficulty taking medications, open capsules and crush tablets, and then hide the drugs in soft foods or liquids. Possible foods include maple syrup, hot fudge, Nutella, apple sauce, jams and jellies, spinach baby food, and chocolate whipped cream, etc. Layer the food and drug on a spoon, and teach the child to take the contents of the spoon without chewing.²³



For information on ordering drugs, see the Supplies, Materials, and Services section.



For consultation regarding the treatment of LTBI in persons who have been in contact with a case who is resistant to drugs in the recommended regimens, contact the local health department and the MDCH TB Control Program at 517-335-8165.

Side Effects and Adverse Reactions

The patient should be monitored by a registered nurse and/or clinician or case manager at least monthly for signs and symptoms of adverse reactions until treatment is completed. If a patient is symptomatic, the provider should be consulted and the patient monitored more frequently. Chemistries and complete blood count (CBC), aspartate aminotransferase (AST)/alanine aminotransferase (ALT), or other tests based on specific drugs should be done periodically. See Table 4: **Monitoring and Interventions for Side Effects and Adverse Reactions** in this section.

As is true with all medications, combination chemotherapy for tuberculosis (TB) is associated with a predictable incidence of adverse effects, some mild, some serious.²⁴ Adverse effects are fairly common and often manageable. Mild adverse effects can generally be managed with symptomatic therapy; whereas, with more severe effects, the offending drug or drugs must be discontinued.²⁵ It is important to strike a balance between continuous provision of appropriate treatment and the mitigation of potentially serious adverse effects.²⁶ Proper management of serious adverse reactions often requires expert consultation.²⁷

Monitor patients for side effects and adverse reactions following the basic monitoring steps listed below.

Basic Monitoring Steps

1. All healthcare workers providing treatment for latent tuberculosis infection (LTBI) should be familiar with the American Thoracic Society (ATS)/Centers for Disease Control and Prevention (CDC) guidelines.
 - a. All jurisdictions should follow the national monitoring guidelines identified in the current treatment guidelines for treatment of LTBI, "Targeting Tuberculin Testing and Treatment of Latent Tuberculosis Infection," pages 26–29 at this hyperlink: <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>.
 - b. It is also important to check for guideline updates posted on the CDC's Division of Tuberculosis Elimination home page at this hyperlink: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm> and the list of guidelines by date at this hyperlink: http://www.cdc.gov/tb/publications/guidelines/List_date.htm.
2. While on treatment, all patients should be evaluated in person, at baseline (before starting treatment), and then at least monthly for side effects and adverse reactions.
3. The common side effects of and adverse reactions to drugs used to treat for LTBI are listed in Table 3: **Reporting Reactions to Antituberculosis Medications**. Educate patients to stop the medicine and promptly report any of the symptoms or signs listed in Table 3 or any unexplained illness to the prescribing clinic immediately.

- a. If a patient reports a potentially serious adverse reaction, call the patient’s provider and the appropriate local health department immediately. For cases in which local health department jurisdiction is unclear or unknown, contact the MDCH TB Control Program at 517-335-8165.
 - b. If a patient reports a potentially less severe side effect, call the patient’s provider immediately and monitor the patient.
4. If you suspect that an antituberculosis drug may be causing a particular side effect or adverse reaction:
- a. Refer to Table 4: **Monitoring and Interventions for Side Effects and Adverse Reactions** below.
 - b. Consult with the local health department and the MDCH TB Control Program at 517-335-8165.
5. If you suspect that an antituberculosis drug may be interacting with other medications that the patient is taking, refer to pages 45–47 in the “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]) at this hyperlink: <http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf>.
6. Document the following patient information:
- a. Review of symptoms, test results, side effects, and adverse reactions
 - b. Education given
 - c. Refill provided
 - d. Description of any problems encountered and action taken for that visit
 - e. Next appointment

Reporting Reactions

The table below is intended for use by a healthcare worker who performs case management services. The healthcare worker should instruct the patient to report to the provider the side effects and adverse reactions listed in Table 3.

If a patient reports a potentially serious adverse reaction to a healthcare worker, the healthcare worker should call the patient’s medical provider and local health department immediately. In cases where adverse reactions may prompt a change in the treatment regimen, consult with the local health department and the MDCH TB Control Program at 517-335-8165, to determine an appropriate new regimen.

If a patient reports a potentially less severe side effect to a healthcare worker, the healthcare worker should immediately call the patient’s medical provider and local health department, and monitor the patient.

Table 3: REPORTING REACTIONS TO ANTITUBERCULOSIS MEDICATIONS²⁸

Potentially Serious Adverse Reactions*	Less Severe Signs and Symptoms*
<p>Immediately report the following signs and symptoms or other abnormalities or unexpected events to the patient's provider. These signs and symptoms suggest side effects, including hepatotoxicity:</p> <ul style="list-style-type: none"> ▪ Jaundice ▪ Dark urine ▪ Vomiting ▪ Abdominal pain ▪ Fever ▪ Visual changes ▪ Marked clinical rash <p>In consultation with the provider, instruct the patient to stop TB medications until evaluated by the provider.</p>	<p>Report the following signs and symptoms to the patient's provider within 24 hours:</p> <ul style="list-style-type: none"> ▪ Anorexia ▪ Nausea ▪ Malaise ▪ Peripheral neuropathy: tingling or burning sensation in hands or feet ▪ Rashes
<p>* These lists are not all-inclusive. For a complete list, refer to the current guidelines for treatment of TB, "Treatment of Tuberculosis" (<i>MMWR</i> 2003;52[No. RR-11]) at this hyperlink: http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf.</p>	

Source: California Department of Health Services(CDHS)/California Tuberculosis Controllers Association(CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. 1998:9. Available at: <http://www.ctca.org/guidelines/index.html>.



The two-month regimen of rifampin and pyrazinamide is no longer recommended due to serious and fatal hepatitis associated with this regimen.²⁹

At present, the CDC Division of Tuberculosis Elimination (DTBE) urges health departments, hospices, hospitals, jails, prisons, and private medical offices to report all severe adverse events (e.g., liver injury, pancreatitis, metabolic acidosis, anaphylaxis, seizure, severe dermatitis) leading to hospitalization or death of a person receiving treatment for LTBI that occurred after January 1, 2004, to DTBE by calling 404-639-8401. Also, if not done previously, please contact the local health to report severe adverse events.

Monitoring for Side Effects and Adverse Reactions by Antituberculosis Drug

Refer to Table 4: **Monitoring and Interventions for Side Effects and Adverse Reactions** to do the following:

- Identify the side effects and adverse reactions associated with particular antituberculosis drugs
- Determine how to monitor for side effects and adverse reactions

Table 4: MONITORING AND INTERVENTIONS FOR SIDE EFFECTS AND ADVERSE REACTIONS^{30,31,32}

Antituberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Isoniazid (INH)	<ul style="list-style-type: none"> ▪ Rash ▪ Hepatic enzyme elevation ▪ Hepatitis ▪ Peripheral neuropathy ▪ Mild central nervous system effects 	<p>Clinical monitoring monthly</p> <p>Liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases ((human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, and pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient is pregnant, in the immediate postpartum period, or at high risk for adverse reactions ▪ Patient has symptoms of adverse reactions 	<p>Hepatitis risk increases with age and alcohol consumption.</p> <p>Pyridoxine (vitamin B6, 10–25 mg/d) might prevent peripheral neuropathy and central nervous system effects.</p> <p>Serum concentrations of phenytoin, disulfiram (Antabuse), and carbamazepine may be increased in persons taking INH. Measure serum concentrations of phenytoin and carbamazepine in patients receiving INH (with or without rifampin), and adjust the dose if necessary.</p>

Antituberculosis Drug	Side Effects/ Adverse Reactions	Monitoring	Comments
Rifampin (RIF)	<ul style="list-style-type: none"> ▪ Rash ▪ Gastrointestinal upset ▪ Hepatitis ▪ Fever ▪ Bleeding problems ▪ Thrombocytopenia ▪ Renal failure ▪ Flu-like symptoms ▪ Orange-colored body fluids (secretions, urine, tears) 	<p>Complete blood count, platelets, and liver function tests (aspartate aminotransferase [AST], alanine aminotransferase [ALT], and serum bilirubin) at baseline in selected cases (human immunodeficiency virus [HIV] infection, history of liver disease, alcoholism, and pregnancy)</p> <p>Repeat measurements if</p> <ul style="list-style-type: none"> ▪ Baseline results are abnormal ▪ Patient has symptoms of adverse reactions 	<p>There are a number of drug interactions with potentially serious consequences. Significant interactions with methadone, birth control hormones, and many other drugs.</p> <p>Contraindicated or should be used with caution when administered with protease inhibitors (PIs) and nonnucleoside reverse transcriptase inhibitors (NNRTIs). Reduces levels of many drugs (e.g., PIs, NNRTIs, methadone, dapsone, ketoconazole, coumadin derivatives, hormonal contraceptive, digitalis, sulfonylureas, diazepam, β-blockers, anticonvulsants, and theophylline).</p> <p>For more information, refer to "Section 7: Drug Interactions" on page 45 in "Treatment of Tuberculosis" at http://www.cdc.gov/mmwr/PDF/rr/rr5211.pdf.</p> <p>Because information regarding rifamycin drug interactions is evolving rapidly, consult the CDC's Division of Tuberculosis "News and Updates" Web page at http://www.cdc.gov/tb/default.htm to obtain the most up-to-date information.</p> <p>Colors body fluids orange.</p> <p>May permanently discolor soft contact lenses.</p>

Adherence

Monitor patients for adherence to self-administered latent tuberculosis infection (LTBI) treatment regimens at least monthly throughout treatment.³³ It is difficult to identify who will and who will not be adherent.³⁴ If patients do not take medicine as directed, the effectiveness of the regimen decreases, and the patient will be at greater risk of progressing to disease in the future and of infecting others.

Monthly Assessment of Adherence

At each visit, the clinician should assess adherence by doing the following:

1. Ask patients how many doses they have missed since their last refill. If patients are asked, “Did you take all your pills last month?” the natural inclination is to agree and say “yes” even if they did not.
2. Have patients bring their bottle of medicine to the refill appointment, and count how many pills are left.
3. If adherence problems are identified, include patients in the problem-solving process.
 - a. Ask patients why they think that doses are missed and what could be done better: change the time of day, the location where they keep or take their pills, etc.
 - b. Find out if there are barriers to obtaining refills in a timely manner that could be corrected.
 - c. Review with patients what they believe is their risk of developing tuberculosis (TB) if medicine is not taken. Provide education again, as needed.
 - d. Mutually agree upon a plan to improve adherence.
 - e. Praise patients for cooperation.
4. If adherence seems to be good, praise patients.



For information on what to include in a patient education session, see the Patient Education section.

Directly Observed Therapy

Patients in the following high-risk groups are strongly recommended for directly observed therapy (DOT).

- DOT is mandatory for any intermittent regimen.
- DOT is strongly encouraged for those with the greatest risk for progression to tuberculosis (TB) disease:
 - Young children who are recent contacts to infectious cases.
 - Human immunodeficiency virus (HIV)-infected persons.



For more information, see the “Directly Observed Therapy” topic in the Case Management section.



For more information on adherence strategies for different developmental stages, see Appendix C in the New Jersey Medical School National Tuberculosis Center’s *Management of Latent Tuberculosis Infection in Children and Adolescents: A Guide for the Primary Care Provider* (New Jersey Medical School Global Tuberculosis Institute Web site; 2004) at this hyperlink:

<http://www.umdnj.edu/globaltb/downloads/products/PediatricGuidelines.pdf>.

Completion of Therapy

Determine whether and when therapy is completed based upon the total number of doses administered, not on the duration of therapy. When patients have had lapses in therapy but are still able to complete the recommended number of doses in the allotted time period, encourage them to complete therapy.

Assess patients who will not complete appropriate therapy within the time frame specified to determine whether or not to restart treatment. If the decision is made to retreat the patient, then restart the entire regimen and follow the recommended treatment plan of therapy. Specific factors to consider when determining whether to restart treatment include the following:

- Individual's risk for developing tuberculosis (TB) disease
- Total number of doses of latent tuberculosis infection (LTBI) treatment administered
- Time elapsed since the last dose of treatment for LTBI
- Patient adherence issues (previous attempts at completion, willingness to continue, etc.)

Give nonadherent patients who are at very high risk of developing TB disease every opportunity to complete treatment for LTBI. Consider these patients for intermittent therapy with directly observed therapy (DOT) and evaluate the use of incentives and enablers.³⁵

Treatment of LTBI in contacts is considered a priority in TB control activities. Make every effort to assure completion of treatment in contacts.

All contacts who are being treated for infection should be seen face-to-face by a healthcare provider at least monthly. Incentives and enablers are recommended as aids to adherence, and the healthcare provider should educate the patient about TB, its treatment, and the signs of adverse drug effects at each patient encounter.³⁶

Table 5 describes the duration of therapy and the number of doses that patients are required to take to complete therapy as well as the time frame within which the total number of doses must be administered for completion of therapy.

Table 5: RECOMMENDED REGIMENS FOR COMPLETION OF THERAPY³⁷

Regimen	Age	Duration of Therapy	Number of Doses	Must Be Administered Within
INH daily	Adult and child	9 months	270	12 months
INH daily	Adult	6 months	180	9 months
INH twice weekly	Adult and child	9 months	76	12 months
INH twice weekly	Adult	6 months	52	9 months
RIF daily	Adult	4 months	120	6 months
	Child	6 months	180	9 months

Definitions of abbreviations: INH = isoniazid; RIF = rifampin.

Sources: CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):26–27; CDC. Regimens. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: <http://www.cdc.gov/tb/webcourses/CoreCurr/index.htm>.

Make every effort to encourage patients to adhere to the LTBI treatment regimen. However, if a patient has failed three attempts to complete treatment, no further effort may be merited. The healthcare provider should contact patients who interrupt therapy and are at high risk of developing TB disease (for example, contacts of patients with infectious TB, human immunodeficiency virus (HIV)-infected patients, or TB Class 4 patients) for reevaluation.³⁸



For consultation regarding completion of therapy and factors to consider when restarting treatment in noncompliant patients, contact the local health department or the MDCH TB Control Program at 517-335-8165.

Treatment in Special Situations

Treatment of latent tuberculosis infection (LTBI) in the following situations requires special consideration:

- Human immunodeficiency virus (HIV) infection
- Alcoholism
- Pregnancy and breastfeeding

Human Immunodeficiency Virus and Latent Tuberculosis Infection



Treatment of latent tuberculosis infection (LTBI) in a person with human immunodeficiency virus (HIV) infection can be extremely complicated. Before treatment is initiated, contact the local health department and the MDCH TB Control Program at 517-335-8165.

HIV infection is the strongest known risk factor for the progression of LTBI to tuberculosis (TB) disease. HIV-infected persons with LTBI are 100 times more likely to progress to TB disease than are those patients without HIV infection. Coinfected HIV and LTBI patients have a seven to ten percent yearly risk of developing TB disease. Patients with only LTBI have a ten percent lifetime risk of developing TB disease.



High-risk contacts (less than five years of age or immunocompromised) should be started promptly on treatment for LTBI. For more information on time frames, see the “Time Frames for Contact Investigation” topic in the Contact Investigation section.

Resources

- CDC. “TB Guidelines: HIV/AIDS” (DTBE Web site). Available at: http://www.cdc.gov/tb/publications/guidelines/HIV_AIDS.htm and <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ATS, CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]:33). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>.
- CDC. “Prevention and Treatment of Tuberculosis among Patients Infected with Human Immunodeficiency Virus: Principles of Therapy and Revised Recommendations” (*MMWR* 1998;47[No. RR-20]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr4720.pdf>.
- CDC. “Updated Guidelines for the Use of Rifabutin or Rifampin for the Treatment and Prevention of Tuberculosis among HIV-infected Patients Taking Protease Inhibitors

or Nonnucleoside Reverse Transcriptase Inhibitors” (*MMWR* 2000;49[No. 9]:185). Available at: <http://www.cdc.gov/mmwr/PDF/wk/mm4909.pdf>.

Alcoholism



For information on treating patients for LTBI who also are known or suspected to abuse alcohol, who drink heavily, or who regularly consume alcohol, see the “Alcoholism” topic under Special Considerations in the Treatment of Tuberculosis Disease section.

Pregnancy and Breastfeeding

Pregnancy has minimal influence on the pathogenesis of TB or the likelihood of LTBI progressing to disease. Pregnant women should be targeted for testing only if they have a specific risk factor for LTBI or for progression of LTBI to disease. Extensive use of isoniazid (INH) during pregnancy has shown that, although it readily crosses the placental barrier, the drug is not teratogenic, even when given during the first four months of gestation. Pregnant women taking INH should receive pyridoxine supplementation.

Breastfeeding is not contraindicated when the mother is being treated for LTBI. However, infants whose breastfeeding mothers are taking INH should receive supplemental pyridoxine. Note that the amount of INH provided by breast milk is inadequate for treatment of the infant.³⁹



American Academy of Pediatrics. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006 (Red Book® Online Web site). Available at: <http://www.aapredbook.org>.

Resources and References

Resources

Whom to Treat

- CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>.
- CDC. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- American Academy of Pediatrics. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006 (Red Book® Online Web site). Available at: <http://www.aapredbook.org>.

Treatment Regimens and Dosages

- CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>.
- CDC. “Update: Adverse Event Data and Revised American Thoracic Society (ATS)/Centers for Disease Control and Prevention (CDC) Recommendations Against the Use of Rifampin and Pyrazinamide for Treatment of Latent Tuberculosis Infection” (*MMWR* 2003;52[No. 31]). Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- CDC. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.

Side Effects and Adverse Reactions

- CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]:26–29, 38–39). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>.
- National Tuberculosis Controllers Association–National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care* (Atlanta, GA;1997:47–51, 63–64).
- CDC. Module 4: “Treatment of Tuberculosis and Tuberculosis Infection” (*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web Site]). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

Adherence

- CDC. Module 9: “Patient Adherence to Tuberculosis Treatment” (*Self-Study Modules on Tuberculosis*. [Division of Tuberculosis Elimination Web Site]). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
This module is entirely devoted to assessing and promoting adherence. It covers the many areas that need to be addressed, such as:
 - Case management: assigning responsibility to the healthcare worker
 - Communication and problem-solving skills
 - Education of the patient
 - Using interpreters when needed
 - Using incentives and enablers
 - Using directly observed therapy (DOT)
- CDC. *Improving Patient Adherence to Tuberculosis Treatment*. (1994)
- National Tuberculosis Controllers Association–National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care* (Atlanta, GA; 1997:69–84).

References

- ¹ CDC. Treatment of latent tuberculosis infection: maximizing adherence. *TB Fact Sheets* [Division of Tuberculosis Elimination Web site]. April 2005;1. Available at: <http://www.cdc.gov/tb/publications/factsheets/treatment.htm>.
- ² CDC. Summary. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ⁴ CDC. Treatment of latent tuberculosis infection: maximizing adherence. *TB Fact Sheets* [Division of Tuberculosis Elimination Web site]. April 2005;1. Available at: <http://www.cdc.gov/tb/publications/factsheets/treatment.htm>.
- ⁵ CDC. Treatment of latent tuberculosis infection: maximizing adherence. *TB Fact Sheets* [Division of Tuberculosis Elimination Web site]. April 2005;1. Available at: <http://www.cdc.gov/tb/publications/factsheets/treatment.htm>.
- ⁶ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):27. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ⁷ CDC. Summary. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ⁸ CDC. Summary. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ⁹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):39. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹⁰ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):10. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹¹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):13. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):38. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹³ CDC. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.

- ¹⁴ CDC, NTCA. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):59, available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm; and CDC, Candidates for treatment of latent TB infection. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ¹⁵ CDC, NTCA. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):59. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹⁶ CDC, NTCA. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):59. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹⁷ CDC, NTCA. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):59. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ¹⁸ Marsh BJ, SanVicente J, vonReyn F. Utility of dual skin tests to evaluate tuberculin skin test reactions of 10 to 14 mm in health-care workers. *Infect Control Hosp Epidemiol* 2003;24:821–4.
- ¹⁹ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):31, 36. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²⁰ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):36. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):4. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²² CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):28–29. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²³ Francis J. Curry National Tuberculosis Center. *Pediatric Tuberculosis: An Online Presentation* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA; 2007:Slides 59–60. Available at: http://www.nationaltbcenter.ucsf.edu/pediatric_tb/.
- ²⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²⁷ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ²⁸ California Department of Health Services(CDHS)/California Tuberculosis Controllers Association(CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. 1998:9. Available at: <http://www.ctca.org/guidelines/index.html>.
- ²⁹ CDC. Update: adverse event data and revised ATS/CDC recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection, United States. *MMWR* 2003;52(No. 31):735–736. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ³⁰ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):26–29, 38–39. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ³¹ CDC. Module 4: treatment of tuberculosis and tuberculosis infection. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- ³² CDC. Update: adverse event data and revised American Thoracic Society/CDC recommendations against the use of rifampin and pyrazinamide for treatment of latent tuberculosis infection—United States. *MMWR* 2003;52(No. 31):735–736. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- ³³ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):20–21, available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>; CDC. Monitoring. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ³⁴ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- ³⁵ County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition*:2-10. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf>.
- ³⁶ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):19. Available at: http://www.cdc.gov/tb/publications/guidelines/Control_Elim.htm.
- ³⁷ CDC. Regimens. In: Chapter 6: treatment of LTBI. *Core Curriculum on Tuberculosis (2004)*. Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm.
- ³⁸ County of Los Angeles Tuberculosis Control Program. *Tuberculosis Control Program Manual: 2003 Edition*:2.10. Available at: <http://www.lapublichealth.org/tb/TBManual/TBmanual.pdf>.
- ³⁹ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):35. Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.

Case Management

CONTENTS

Introduction.....	9.2	Completion of Therapy.....	9.26
Purpose.....	9.2	Verifying adequate course of treatment	9.26
Policy	9.3	Calculating completion of therapy	9.27
Forms.....	9.4	Closures other than completion of therapy.....	9.27
Acknowledgments.....	9.4	Evaluation.....	9.28
Initial Assessment	9.5	Evaluation activities.....	9.28
Cultural sensitivity and language issues.....	9.5	Directly Observed Therapy	9.30
Patient's medical records.....	9.6	Candidates for directly observed therapy.....	9.30
Assessment site.....	9.6	How to deliver directly observed therapy	9.31
Discharge planning	9.6	Adherence to directly observed therapy.....	9.32
Initial assessment activities.....	9.6	Incentives and Enablers.....	9.35
Treatment Plan.....	9.11	Eligible patients	9.35
Treatment plan components	9.12	Available incentives and enablers.....	9.35
Planning activities	9.13	Legal Orders.....	9.37
Implementation activities.....	9.14	Progressive interventions	9.37
Ongoing Assessment		Types of legal orders and	
and Monitoring.....	9.16	how to process them	9.40
Ongoing assessment activities	9.16	Resources and References.....	9.41
Monitoring side effects and			
adverse reactions.....	9.20		
Activities to monitor for side effects and			
adverse reactions.....	9.21		
Monitoring bacteriologic improvement	9.21		
Activities to monitor for bacteriologic and			
clinical improvement	9.22		

Introduction

Purpose

Tuberculosis (TB) case management describes the activities undertaken by a local health department its partners to ensure successful completion of TB treatment and cure of the patient.¹ Case management is a system in which a specific health department employee is assigned primary responsibility for the patient, systematic regular review of patient progress is conducted, and plans are made to address any barriers to adherence.²

Use this section to understand and follow national, MIACET and State of Michigan guidelines to do the following:

- Conduct initial assessments.
- Develop treatment plans for case management activities.
- Conduct monthly ongoing assessments.
- Monitor adverse reactions to anti-tuberculosis medications and monitor toxicity.
- Monitor bacteriologic and clinical improvement.
- Verify completion of therapy.
- Evaluate case management activities.
- Provide directly observed therapy (DOT).
- Use incentives and enablers to improve adherence to therapy.
- Understand when and how to use legal orders, if necessary, for adherence to therapy.

One of the four fundamental strategies to achieve the goal of TB control in the United States is the early and accurate detection, diagnosis, and reporting of TB cases, leading to initiation and completion of treatment. Completion of a full course of standard therapy is essential to prevent treatment failure, relapse, and the development of drug resistance.³

One reason for failure to complete standard treatment is that patients frequently fail to adhere to the lengthy course of treatment. Poor adherence to treatment regimens might result from difficulties with access to the healthcare system, cultural factors, homelessness, substance abuse, lack of social support, rapid clearing of symptoms, or forgetfulness.⁴

These adverse outcomes are preventable by case-management strategies provided by TB control programs, including use of DOT.⁵ It is strongly recommended that the initial treatment strategy utilize patient-centered case management with an adherence plan that emphasizes DOT.⁶ It is essential to provide patient-centered case management in

which treatment is tailored and supervision is based on each patient's clinical, social and economic circumstances.⁷ Programs utilizing DOT as the central element in a comprehensive, patient-centered approach to case management (enhanced DOT) have higher rates of treatment completion than less intensive strategies.⁸

Policy

Although some patients may undergo most of their evaluation and treatment in settings other than a local public health agency, a local public health agency should undertake the major responsibility for monitoring and ensuring the quality of all TB-related activities in the community as part of its duties to protect the public health.⁹

Effective TB case management requires administrative commitment and support. This includes education, staff training, and ensuring adequate funding to maintain program activities.¹⁰ It is recognized that local public health agencies differ in their staffing and organization and that no set of guidelines can cover all the situations that may arise relating to case management.¹¹



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

Forms



Required and recommended forms and links are available on the MDCH Tuberculosis Program web page at <http://www.michigan.gov/tb> and the TB Toolkit section of the MIACET web page: <http://www.michigantb.org/hcp/tool.asp>.

Reporting requirements: Please refer to the Surveillance Chapter for TB reporting requirements.

Recordkeeping requirements: Record keeping requirements are established by each local health jurisdiction. Please refer to the Surveillance Chapter for MDCH retention practices.

Acknowledgments

The authors want to acknowledge the extensive use of two non–Centers for Disease Control and Prevention (CDC) sources for the content in this section.

The New Jersey Medical School National Tuberculosis Center’s *Tuberculosis Case Management for Nurses: Self-Study Modules* course is a comprehensive and well-written overview of case management for a national audience. The text for large portions of the “Initial Assessment,” “Treatment Plan,” and “Ongoing Assessment and Monitoring” topics was taken and/or adapted from the second module of this self-study course.

The California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA) “TB Case Management—Core Components” guideline provides another comprehensive source of recommendations on case management practices. This guideline is one in the series of *CDHS/CTCA Joint Guidelines* and is used throughout urban and rural areas in California. Some content in the “Ongoing Assessment and Monitoring” topic was taken from the “TB Case Management—Core Components” guideline.

Initial Assessment

Conduct initial assessments of tuberculosis (TB) patients to gather data that will form the basis for TB treatment and care. It is essential to gather data to determine the clinical, social and economic issues and circumstances of relevance to the patient and to assess each situation objectively to determine the appropriateness of the planned intervention. Many professionals involved in the patient's care contribute to the assessment data, and the case manager gathers assessment data from many sources, including community agencies, primary care providers, schools, and other healthcare facilities.¹²



When the patient with TB is a child, the case manager should involve both the child and family in the assessment process.¹³



To document assessment data, use the TB Assessment Form from the TB Toolkit section of the MI-ACET webpage at <http://www.michigantb.org/hcp/tool.asp>, or in the "Assessment for Patient Adherence or Difficulty" section of the Patient Education chapter of this manual.

Cultural Sensitivity and Language Issues

In the initial assessment, consider cultural sensitivity and language issues. To improve the validity and quality of the assessment information, healthcare workers need to be culturally sensitive in approaching each patient. A medical interpreter may be needed for patients whose primary language is not English.



For more information on cultural sensitivity, refer to the *Participant's Workbook* for Session 4: "Working with Culturally Diverse Populations" in *DOT Essentials: The DOT Trainer's Curriculum* (Francis J. Curry National Tuberculosis Center Web site; 2003) at this hyperlink: <http://www.nationaltbcenter.ucsf.edu/catalogue/epub/index.cfm?uniqueID=2&tableName=DOTE>.



For assistance with language issues, see the National Health Law Program and The National Council on Interpreting Health Care's *Language Services Resource Guide for Health Care Providers* (National Health Law Program Web site; October 2006) at this hyperlink: <http://www.healthlaw.org/library.cfm?fa=download&resourceID=89928&appView=folder&print> . Please note that this download is very slow.



For more information on using interpreters, see the *Interpretation Services* lesson in Module 9: “Patient Adherence to Tuberculosis Treatment” of the CDC’s *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web site; 1999) at this hyperlink: <http://www.phppo.cdc.gov/phtn/tbmodules/modules6-9/m9/9-12.htm> .

Patient’s Medical Records

All medical records are needed in order to provide case management and recommend a treatment plan. Prior to the visit with the patient, the case manager should ensure that a copy of all of the patient’s medical records (from hospitals, clinics, and other healthcare providers) and chest radiographs are available to the treating physician. Without the medical records, the physician may not be able to make the correct judgments in medical management.¹⁴

Assessment Site

The case manager (or designee) should make an initial hospital visit within (3) THREE working days of a referral or case report to assess the condition of the patient and begin the contact investigation.

If the patient is hospitalized, conduct the initial assessment during the patient’s hospitalization. If the patient is not hospitalized, conduct the initial assessment at the first clinic visit or during a home visit.

Discharge Planning



Patients who are diagnosed with TB during a hospitalization will require discharge planning. The case managers should ensure that appropriate discharge planning occurs for all patients with TB, to prevent transmission in the community and interruption in treatment.¹⁵

Initial Assessment Activities

To complete an initial assessment, perform the following activities:

- Visit the patient’s home.
- Obtain or review demographic information.
- Ascertain the extent of TB illness.
- Obtain and review the patient’s health history.
- Determine infectiousness or potential infectiousness.

- Evaluate the patient's knowledge and beliefs about TB.
- Initiate treatment, if not initiated during the hospital stay.
- Monitor the TB medication regimen.
- Identify any barriers or obstacles to adherence.
- Review psychosocial status.
- Identify and document a thorough history of the patient's social network.
- Gather information for a possible contact investigation.

Visit the patient's home. During the patient's TB treatment, at least one or more home visits are required. Home visits are useful for confirming the patient's address, particularly for patients at high risk for default from treatment. Information gathered at the patient's home is often more revealing than assessments performed in the clinical or health department settings and can lead to a more accurate understanding of the patient's lifestyle (for example, seeing a child's shoes or toys when a child was not named in the contact investigation).¹⁶ Several home visits may be needed because it is unlikely to gather all of the necessary information from the patient and family at one time.

Obtain or review demographic information, including the name, address, telephone number(s), birth date, Social Security number, and health insurance provider's name, address, and identifying information.¹⁷

Ascertain the extent of TB illness, including acuity and length of symptoms, bacteriologic and radiographic findings, laboratory analyses, tuberculin skin test (TST) or Interferon Gamma Release Assay test results, nutritional status, vital signs, and baseline weight (without shoes or excess clothing). Assess temperature, pulse, and respiration if the patient appears ill or the history suggests illness. Blood pressure evaluations are valuable, especially if the patient has no primary care provider.

Diagnostic activities should be completed within specific time frames. The responsible physician and/or program medical consultant should be consulted within (1) ONE working day of receipt of a suspect report. Within (2) TWO weeks of a case report, a tuberculin skin test should be placed, measured, and interpreted; and a chest radiograph should be taken and interpreted within (7) SEVEN days. Also within (1) ONE week of a case report, a minimum of three consecutive sputum specimens of good quality should be collected 24 hours apart (with at least one being an early morning specimen) and submitted to the laboratory.



In the case of pulmonary TB in children younger than five years of age, posterior-anterior and lateral chest radiographs are important in the initial diagnosis.¹⁸ Adults who are suspected of TB or who are active cases usually need only an initial posterior-anterior chest radiograph.

Obtain and review the patient's health history to determine concurrent medical problems, including human immunodeficiency virus (HIV) disease or risk factors, country

of birth, sexual history, allergies, or medications that may interfere with TB drugs. The case manager should obtain the names, addresses, and telephone numbers of the patient's primary care provider and any specialists involved in his or her medical care, previous hospitalizations, allergies, and current medications. It is important to know the patient's history of treatment for TB infection and/or disease, especially for those who are treatment failures or have a relapse of TB disease, as they are at a higher risk for developing multidrug-resistant TB (MDR-TB). It is also important to determine what the patient perceives as his or her most important medical/health problem. The date of the last menstrual period and contraceptive use should be obtained from female patients.¹⁹



Some antituberculosis medications are contraindicated when a patient is taking birth control pills. For more information, see the “Side Effects and Adverse Reactions” topic in the Treatment of Tuberculosis Disease section.

Determine infectiousness or potential infectiousness. To determine the need for and scope of the contact investigation, the initial assessment should gather information to define the start and end dates of the period of infectiousness. This assessment should include the duration and frequency of symptoms, especially cough, and a review of the radiographic findings. If the patient is infectious or potentially infectious, the case manager should have an understanding of the period of infectiousness. The parameters of a contact investigation, including the need for repeating the tuberculin skin test for contacts that were initially negative, can then be determined.²⁰



In the case of a child with TB who is younger than five years, the contact investigation should focus on determining the source case of TB, since young children are not likely to transmit TB. Dates of exposure and most recent information concerning the infectiousness of the source case should be documented.



For more information on the period of infectiousness and contact investigations, see the Contact Investigation section.

Evaluate the patient's knowledge and beliefs about TB, including a history of TB in family and/or friends and the response to treatment. The case manager can assess TB knowledge by interviewing the patient regarding TB transmission, pathogenesis, and symptoms. Patient education should be based on current knowledge and ability to comprehend written, visual, and/or verbal information.²¹



It is important to interview both the child and parent or guardian in their own language when assessing TB knowledge; however, adolescents should be given the opportunity to speak to a healthcare provider alone. Keep in mind that parents who have misinformation or cultural bias about TB may affect their children's understanding of the disease.²² Use age-appropriate educational materials and methods, especially when working with children. When working with a school-aged child, it is important to explain that TB is treatable, and with the adolescent, it may be necessary to constantly reaffirm confidentiality.²³

Initiate treatment, if not initiated during the hospital stay. A clinician should initiate medical treatment within (3) THREE days of positive acid-fast bacilli (AFB) sputum smear results (unless there is evidence that the AFB is not *Mycobacterium tuberculosis* complex, e.g., by direct test of sputum) or a presumptive diagnosis. A clinician should complete medical evaluations within (1) ONE month of a referral, then every month thereafter. Within (3) THREE working days of receipt of medical orders which document drugs, dose, route, frequency, and duration, the case manager should order drugs. The case manager then should initiate treatment within (3) THREE days of receiving the drugs.

Monitor the TB medication regimen. The case manager should ensure that medications and dosages are prescribed according to current American Thoracic Society (ATS)/Centers for Disease Control and Prevention (CDC) guidelines. If the initial assessment occurs during the patient's hospitalization, the case manager should ensure that the ingestion of the TB medication is observed by a nurse. It is important to ensure that hospitals order and give the right doses and are observing patients taking medications. Since the outpatient phase of treatment will involve giving TB medications at one time, hospitals should be discouraged from splitting dosages for two reasons: (1) taking medications more than once a day creates an expectation for the patient that will have to change after discharge from the hospital, and (2) tolerance to the full dosage cannot be assessed while in the hospital. The patient's tolerance to TB medications should be noted, and interactions with other medications should be determined prior to the patient starting TB medications.²⁴



For more information on treatment regimens and dosages, see the Treatment of Tuberculosis Disease section.



If the medications will be given to a child in a school or daycare setting, parental authorization must be obtained.

Identify any barriers or obstacles to adherence in taking TB medications and keeping physician or clinic appointments. This includes such issues as language, availability of transportation, the patient's preference for place and time of directly observed therapy (DOT), and the ability to swallow pills. Many adolescents and adults who have difficulty swallowing pills are embarrassed to report this to the healthcare provider. It may be necessary to teach people how to take pills, or it may be necessary to crush the pills and put them in food, such as pudding or applesauce. In addition, the case manager should determine the need for enablers and identify incentives that will be most valuable to the patient.

Review psychosocial status to identify unmet needs, the use of alcohol and/or illegal drugs, and any pre-existing psychiatric diagnoses.²⁵

Identify and document a thorough history of the patient's social network. This is important to identify and document in the event that the patient does not return for follow-up. The case manager needs to verify the patient/family's address, evaluate residential stability, and assess potential for homelessness. Determine the patient's residence(s) during the past year, particularly any congregate living situations, such as prison, jail, homeless shelter, nursing home, boarding home, or foster care. Establish the patient's occupation and/or student status, and document the name and address of business or school. The name and location of a child's babysitter, other caretakers, daycare center, and/or school should be noted. In order to identify those who have shared common air space with the infectious, untreated patients with TB, it is necessary to have an understanding of the patient's social and recreational activities and how he/she spends leisure time. This includes time spent at bars, floating card games, circuit parties, faith-based functions, and other venues.

Gather information for a possible contact investigation. A contact investigation should begin within (3-7) THREE to SEVEN days of a case/suspect report and be completed within (3) THREE months.



For more information, see the Contact Investigation section.

Treatment Plan

When sufficient information has been gathered by members of the healthcare team to assess a patient's needs and problems, the case manager should develop a treatment plan for each patient with confirmed or suspected tuberculosis (TB). The plan should combine both medical management of the patient and nursing interventions. Due to the length of TB treatment (from 6 to 24 months), the plan must include intermediate and expected outcomes.

To ensure that therapy is completed, a treatment plan should be based on data collected by the healthcare team and must be designed to meet the patient's medical and personal needs. Treatment of a patient with TB is most successful within a comprehensive framework that addresses both clinical and social issues of relevance to the patient. Patient-centered care is essential to provide because it tailors treatment and bases supervision on each patient's clinical and social circumstances.

Each patient's management plan should be individualized to incorporate measures that facilitate adherence to the drug regimen, such as social service support, treatment incentives and enablers, housing assistance, referral for treatment of substance abuse, and coordination of TB services with those of other providers.²⁶

In the initial management strategy, regardless of the source of supervision, always include an adherence plan that emphasizes directly observed therapy (DOT), in which patients are observed as they ingest each dose of anti-tuberculosis medications, to maximize the likelihood of completion of therapy.²⁷

The case manager is responsible for the overall plan, including documentation, monitoring the patient response, interventions, intermediate and expected outcomes, and initiating changes in the plan to reflect changes in circumstances.²⁸ The treatment plan should be reviewed and updated at least monthly, and as needed during reviews of clinical progress.²⁹

Treatment Plan Components

The components of a treatment plan include the following:

- Patient's verified address and contact information
- Assignment of responsibilities: case manager, clinical supervisor (nurse, physician, or physician assistant), DOT workers, other caregivers (outreach workers, nurses), and person managing the contact investigation
- Patient educator's name and dates of education sessions
- Method for prevention of transmission: no isolation, airborne infection isolation, home isolation, legal order for isolation
- Planned course of anti-tuberculosis drug therapy
- Estimated date of completion of treatment
- Test results from initial medical evaluation
- Medical history
- Diagnosis
- Monitoring activities and schedule to assess response to therapy
- Baseline tests, monitoring activities, and schedule to detect potential side effects and adverse reactions
- Potential drug interactions
- Potential treatment adherence obstacles
- Personal service needs
- Referrals for social services
- Means of ensuring successful completion of treatment (DOT, incentives, enablers)
- Location(s) where DOT will be administered
- Approvals and signatures of the attending physician, local public health agency representative, and the patient
- Intermediate and expected outcomes³⁰



For a list of intermediate and expected outcomes, see *Module 2: "Fundamentals of TB Case Management,"* pages 23–25 in the New Jersey Medical School National Tuberculosis Center's *Tuberculosis Case Management for Nurses: Self-Study Modules* (New Jersey Medical School Global Tuberculosis Institute Web site) at this hyperlink:
<http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> .

Planning Activities

To complete planning, perform the following activities:

- Establish the treatment plan.
- Establish time frames in the treatment plan to monitor the plan and patient response.
- Negotiate and adjust the treatment plan.

Establish the treatment plan, ensuring that all the components are included. The case manager should ensure that the treatment plan is useful and meaningful. It becomes the internal standard of care for the patient as well as the performance standard for the case manager. Good planning will allow the patient to experience TB care and treatment along the healthcare continuum and prevent duplication and fragmentation of services. The plan should be discussed and validated with all team members and the patient.³¹ DOT should be the standard of care for all TB cases and suspects.

Establish time frames in the treatment plan to monitor the plan and patient response. Monitoring should be done at least every month at the patient's home, ambulatory clinic, health department, or private physician's office. Each component of the plan should be reviewed to ensure that it is an accurate accounting of the patient's problems, required tests, and interventions. To track progress toward outcomes, document all treatment activities and their dates: medications taken, tests and results, patient visits, monitoring activities, side effects, adverse reactions, education sessions, social service referrals, incentives, enablers, isolation status changes, and patient problems.³²

Negotiate and adjust the treatment plan as needed, to meet new realities. Since patient circumstances are usually fluid and personnel resources often change over time, it is essential that the plan be negotiated with the patient and changed to adjust to new situations. The adjusted plan should be discussed with the team members, as well as the patient.³³

Implementation Activities

To begin implementation of the treatment plan, perform the following activities:

- Refer the patient to other healthcare providers, social service agencies, or community organizations as needed.
- Broker and locate needed services relating to TB treatment.
- Negotiate a plan for DOT or self-administration evaluation.
- Coordinate strategies to improve adherence.

Refer the patient to other healthcare providers, social service agencies, or community organizations, as needed. The referral process requires the case manager to locate and coordinate accessible, available, and affordable resources for the patient. After the referral is made, the case manager should monitor the patient's adherence to the referral and obtain the consultation or follow-up report in writing. Immediate intervention may be necessary if the patient or the referring agency experiences difficulty.³⁴ All patients with suspected or proven TB should be assessed for HIV risk and offered counseling and voluntary testing for HIV, with referral for HIV treatment services when necessary. Referrals to medical specialists for conditions that would endanger the patient and/or affect the outcome of treatment should be made as soon as possible. The patient should be sent to an emergency department if the condition is serious when assessed by the case manager. The case manager should follow up a referral to obtain medical information and determine whether the necessary medical intervention has been completed.

Broker and locate needed services relating to the TB treatment. This may include laboratory, auditory, or visual acuity testing; additional radiographs; or other tests required specifically for the patient. It is important to schedule or assist the patient in scheduling appointments and to monitor the patient's adherence. An understanding of the patient's financial resources and health insurance coverage is important. Lack of financial resources or health insurance will affect the patient's willingness to keep appointments, which may be critical to his or her health. The case manager may need to discuss essential services with insurance companies or other healthcare providers to obtain the most cost-effective, quality service.³⁵ Assistance should be provided to reinforce a patient's efforts to receive financial assistance and treatment for psychosocial, alcohol-related, and drug-related conditions.

Negotiate a plan for DOT or self-administration evaluation. DOT should be the standard of care for all patients. The case manager should ensure the plan is suitable for the patient's needs and achievable by the healthcare provider(s) and then have the patient sign a DOT agreement. Due to the length of TB treatment, the patient's circumstances may change. The case manager needs to verify that the time and place for DOT administration originally agreed upon is still agreeable to the patient and

provider. It also may be necessary to coordinate the arrangements for DOT with outside organizations, such as school nurses or drug treatment center nurses.³⁶



Refer to the “Directly Observed Therapy” topic in this section.

Coordinate strategies to improve adherence. The case manager must have knowledge of and proficiency in strategies to improve patient adherence, understand the importance of developing and maintaining a therapeutic relationship, and be familiar with the principles and practices of behavioral contracting and behavioral modification. Collaboration with team members is essential to obtain as much information as possible about strategies to improve adherence of individual patients and elicit opinions, attitudes, and feelings expressed by the patient. Incentives and enablers should be considered for use with all patients. Depending upon the obstacles to completion of therapy, the treatment plan also may include incentives and enablers, and, to be effective, incentives and enablers should be meaningful and specific for a particular patient.³⁷



For more information on incentives and enablers, see the “Treatment of Tuberculosis” topic, Table 8, and the “Incentives and Enablers” topic in this section.

Ongoing Assessment and Monitoring

Conduct ongoing assessments and monitor patients at least every month, either in an ambulatory clinic setting, local public health agency, or private physician's office. Schedule additional assessments throughout the month for patients experiencing problems with their tuberculosis (TB) treatment, or for those patients who are nonadherent to directly observed therapy (DOT) or follow-up appointments.³⁸

There are countless stories from nurses and outreach workers reinforcing the fact that not all information is obtained from the patient or family at one time. Therefore, the case manager must ensure that the list of contacts is updated from time to time and determine the need for further testing. It is also important to review the status of the contact investigation to ensure that timelines and standards are followed. Also, checking for the accuracy of previously gathered information should occur throughout the patient's TB treatment.³⁹



For the reporting schedule, see Table 3: **Required Reports** in the “Required Reports from Local Public Health Agencies to the MDCH Tuberculosis Program” topic in the Surveillance section.

Ongoing Assessment Activities

To complete an ongoing assessment, perform the following activities:

- Monitor the clinical response to treatment.
- Determine human immunodeficiency virus (HIV) status and the risk factors for HIV disease, and refer the patient for treatment, if indicated.
- Review the treatment regimen.
- Ensure that medications are ordered and given at the correct time, and in the correct dosage.
- Monitor the side effects of and adverse reactions to medication.
- Assess adherence daily and monthly, and identify positive and negative motivational factors influencing adherence.
- Determine the unmet educational needs of the patient.
- Educate the patient about the TB disease process.
- Advocate for the patient with team members and other service providers.
- Review the status of the contact investigation, if one was started.

Monitor the clinical response to treatment by reviewing vital signs, weight, bacteriologic reports, and radiographic results, including drug susceptibility results and TB symptoms, comparing them to previous documented findings. This review is an important measurement of clinical improvement, worsening, or stabilization of the patient's condition. The case manager should collect sputa for acid-fast bacilli (AFB) sputum smear and culture, initially every day for (3) THREE days, then weekly until sputum smear conversion, then daily for (2) TWO days until a total of (3) consecutive negative AFB smears. Thereafter, sputa should be collected every month until there are two negative cultures. If a patient is on DOT, no further specimen collected is indicated unless the patient becomes symptomatic. A clinician should complete a medical evaluation every month until treatment is completed, and periodically based on patient condition or review of diagnostic information, patient chart, and chest radiographs. If the patient's condition is worsening, interview the patient to determine the potential cause(s) for the worsening condition. List all bacteriologic reports in chronological order, and correlate them with the patient's current symptoms history and chest radiograph report to ensure accuracy. Also, conduct this review at conversion as evidence for the improving condition of the patient.⁴⁰



Inconsistencies should trigger additional questions, such as the possibility of laboratory contamination. Bring these questions immediately to the attention of the physician and MDCH TB Program at 517-335-8165.⁴¹



A child's clinical response to treatment may not be as significant as that of an adult. Therefore, it is important to reinforce what the expected response to treatment should be for the individual child during the course of treatment.⁴²

Determine HIV status and the risk factors for HIV disease, and refer the patient for treatment, if indicated. It is important for patients to understand the correlation between TB and HIV disease. The case manager should ensure that HIV counseling and testing are done at the beginning of TB treatment, if the HIV status is not previously known. If the patient refuses HIV testing, an assessment of the risk factors for HIV should be completed.⁴³ If a patient refuses, voluntary HIV testing and counseling should continue to be offered periodically throughout treatment.

If the parents of a young child with TB refuse to permit the child to be HIV tested, the parents should be interviewed regarding the child's risk of HIV disease, including neonatal transmission.⁴⁴

Review the treatment regimen to verify that the physician's orders are clear and concise. One of the case manager's primary responsibilities is to ensure that the patient completes treatment according to the physician's orders. It is also important to ensure that the plan is specific for the individual patient and follows the principles of TB treatment.⁴⁵

Ensure that medications are ordered and given at the correct time, and in the correct dosage. Review the patient's treatment plan and chart, and correct the medications as necessary.

Monitor the side effects of and adverse reactions to medication. Review laboratory findings and contact the treating physician if abnormal results are obtained.⁴⁶ The patient should be monitored by a registered nurse and/or clinician or case manager at every DOT visit for signs and symptoms of adverse reactions until treatment is completed. If a patient is symptomatic, the provider should be consulted and the patient monitored more frequently. Chemistries and complete blood count (CBC), aspartate aminotransferase (AST)/alanine aminotransferase (ALT), or other tests based on specific drugs should be done periodically per orders from local public health jurisdiction schedule, or order from the treating physician. See Table 8: **Monitoring and Interventions for Side Effects and Adverse Reactions** in the Treatment of Tuberculosis Disease section.



If a child is taking TB medications at school, communicate at a minimum on a monthly basis with designated staff to determine whether the child is experiencing medication side effects or adverse reactions.⁴⁷

Assess adherence daily and monthly, and identify positive and negative motivational factors influencing adherence. An assessment of adherence needs to occur at each patient encounter. Direct observation provides immediate information on poor adherence and adverse effects. The key to a successful DOT program is the timely use of this information in order to promptly identify and respond to potential barriers to adherence, missed doses, and potential adverse treatment effects. If the case manager is not involved in providing DOT, a notification system should alert him or her if the patient misses a DOT dose or if there is suspicion of nonadherence if the case is on self-administered therapy. A preventable interruption in treatment can be avoided if the case manager is notified immediately, rather than when the monthly DOT rate is calculated. If a DOT dose is missed, the patient should be contacted the same day or the next business day and the issue escalated to the case manager's supervisor. It is important not to send a mixed message to a patient by not promptly responding to missed DOT doses.

If the patient is self-administering TB medications, make a weekly visit to the patient's residence to assess adherence and monitor for side effects and adverse reactions. Also, regularly monitor the effectiveness of enhancement methods (i.e., incentives, enablers, behavioral contracting, or behavior modification).⁴⁸

Policies and procedures must be in place to establish the expected monthly rate of DOT adherence. The case manager should review the monthly adherence rate to ensure that patients achieve the expected adherence rate. DOT should be initiated if adherence is compromised, as evidenced by missed pill pick-up appointments, inaccurate pill counts, etc., in persons at high risk of developing TB disease. The case manager should ensure

that the patient is informed about the consequences of nonadherence, including legal interventions. Changes in the patient's attitude toward the healthcare worker should be noted and verified with the patient.⁴⁹



For more information, see the “Directly Observed Therapy” and “Legal Orders” topics in this section.

Determine the unmet educational needs of the patient regarding transmission, diagnosis, and treatment of TB. Identify the concerns and anxieties regarding diagnosis, and need for further education. The educational needs of the patient/family may vary throughout the course of treatment. Patient education also will vary depending on beliefs about TB treatment, acceptance of the diagnosis, coping mechanisms, cultural values, and the accuracy of the information they have already received. The case manager should explore the effect the diagnosis has on the patient's relationships with other family members, coworkers, and social contacts so that appropriate, culturally sensitive information can be provided.⁵⁰

Educate the patient about the TB disease process during the course of TB treatment. Provide instruction relevant for the patient's level of education or ability to learn, and address healthcare beliefs that are in conflict with educational information. The case manager should ensure that education is provided in the patient's primary language and that it is culturally appropriate.⁵¹ The case manager should provide patient and family education initially, and then at least every month until satisfactory recall is obtained. Ongoing patient and family education is preferred, throughout the TB treatment.



For more information, see the Patient Education section.

Advocate for the patient with team members and other service providers when necessary. The case manager should demonstrate respect and understanding of the patient's cultural beliefs and values and should prevent team members from imposing their own values or belief systems on the patient. The case manager should be able to communicate the patient's fears/anxieties, likes/dislikes, and needs/wants to the team members in a nonjudgmental manner. The case manager must also have an understanding of the team members, and mediate, negotiate, and resolve differences of opinion regarding the patient and interventions.⁵²

Review the status of the contact investigation, if one was initiated. Patients may not initially reveal the names of all close contacts, but over time more individuals are often identified.⁵³ A contact investigation should begin within (3-7) THREE to SEVEN days of a case/suspect report and be completed within (3) THREE months. The investigation should be repeated if for any reason the index patient becomes AFB sputum smear

positive again during treatment and there has been sufficient exposure for the skin-test-negative persons to become infected.

Monitoring Side Effects and Adverse Reactions

Assess and document side effects and adverse reactions to anti-tuberculosis medications and monitor toxicity. The patient should be monitored by a registered nurse and/or clinician or case manager every DOT visit for signs and symptoms of adverse reactions until treatment is completed. If a patient is symptomatic, the provider should be consulted and the patient monitored more frequently. Chemistries and CBC, AST/ALT, or other tests based on specific drugs should be done periodically per orders. See Table 8: **Monitoring and Interventions for Side Effects and Adverse Reactions** in the Treatment of Tuberculosis Disease section.

As is true with all medications, combination chemotherapy for TB is associated with a predictable incidence of adverse effects, some mild, some serious.⁵⁴ Adverse effects are fairly common and often manageable. Mild adverse effects can generally be managed with symptomatic therapy; whereas, with more severe effects, the offending drug or drugs must be discontinued. It is vital that first-line multiple-drug therapy not be stopped without adequate justification⁵⁵, and to recognize key adverse reactions that indicate when a drug should not be used. In addition, proper management of more serious adverse reactions often requires expert consultation.⁵⁶



Instruct patients to report the side effects and adverse reactions listed in the “Side Effects and Adverse Reactions” topic in the Treatment of Tuberculosis Disease section.

Activities to Monitor for Side Effects and Adverse Reactions

To monitor for side effects and adverse reactions, perform the following activities:

- Educate the patient and family to report side effects and adverse reactions
- Assess the patient for side effects and adverse reactions

Educate the patient and family to report side effects and adverse reactions. The case manager reinforces prior patient teaching and continues to educate the patient and family about TB medications, signs and symptoms of adverse effects, and the importance of continued treatment and uninterrupted drug therapy. Case managers should be familiar with all TB medications, their side effects, contraindications, and drug interactions.⁵⁷



For more information, see the Patient Education section.

Assess the patient for adverse reactions and side effects. For patients on self-administered therapy, the case manager ensures that patients are assessed for adverse effects to TB medications at least every week and at each visit. If the patient is on DOT or pill counts, staff should assess patients for side effects and adverse reactions on each visit by performing a symptom review. If indicated, order liver function tests and monitor their results. The case manager should be aware of complications in patients on medications by maintaining close communication with outreach staff.⁵⁸

Monitoring Bacteriologic Improvement

TB patients are considered infectious, requiring isolation from the general population, when their sputum contains high enough numbers of acid fast bacilli (AFB) to be detected by microscopic examination. Microscopic examination for AFB is the least sensitive laboratory test for AFB, requiring at least 100,000 AFB in every milliliter of sputum to be seen using a microscope. As antibiotic therapy begins to work, the number of AFB in the patient's sputum will go down and AFB smear results will become negative. With adequate and appropriate antibiotic therapy, AFB slide results normally become negative after a couple of weeks, depending upon the extent of the lung infection at the point in time when antibiotic therapy was initiated. The greater the extent of lung involvement or the more cavitation seen on X-ray, the longer it takes for AFB slide results to become negative, i.e. the patient to be considered non-infectious and released from isolation. In some cases, when there is extensive cavitation in the lung, sputum specimens may remain AFB positive for several months, sometimes even after the AFB have been rendered non-viable and AFB culture results have become negative.

Acid-Fast Bacilli Smear Results (Sputum)

AFB Slide Positive and diagnosed with pulmonary tuberculosis

- 1. New TB Patient (patient with no prior history of Tuberculosis):** Notify the local health department and provider, and initiate isolation of the patient. Repeat collection of three early morning sputum specimens on three successive days to confirm the initial result. Then, weekly, collect three sputum specimens on three successive days, submit to the laboratory and monitor AFB slide results. The patient is considered safe to release from isolation when negative AFB smear results have been reported on three consecutive sputum specimens.
- 2. Past TB Patient (patient with prior history of tuberculosis):** Notify the local health department and provider, and initiate isolation of the patient. Chart AFB slide results to the patient's record. Each week, collect three sputum specimens on three successive days, and monitor AFB slide results. The patient is

considered safe to release from isolation when negative AFB smear results have been reported on three consecutive sputum specimens.

AFB Slide Negative and previously diagnosed with pulmonary tuberculosis

Numbers of AFB are too low to be detected by AFB microscopy. If AFB smears of sputum collected on three successive days are negative, consider removing from isolation.

AFB Slide Negative and no prior history of tuberculosis

Numbers of AFB are too low to be detected by AFB microscopy. When negative AFB slide reports are received on three sputum specimens collected on three successive days, there is no laboratory basis for supporting a diagnosis of tuberculosis. If the patient has been clinically diagnosed with tuberculosis based upon signs, symptoms, positive skin test, etc., then the patient is not infectious and does not need to be isolated from the general population.

Culture Positive for *M.tuberculosis* complex

Patients found culture positive for *M.tuberculosis* complex should be retested by collecting three sputum specimens on three successive days, at least monthly, until negative culture results are obtained.

Continued Positive Sputum Smears or Cultures

If a TB Patient's sputum smears and/or cultures continue to be positive after six weeks of antibiotic TB therapy, contact the local health department and the MDCH TB Control Program at 517-335-8165. A patient who continues to produce sputum smear positive results or AFB positive cultures after 6 weeks of appropriate antibiotic therapy should be evaluated for treatment failure or development of antibiotic resistance. Drug resistance due to inadequate therapy requires 4-6 weeks to develop. Positive AFB slide and culture results which continue after 6 weeks of therapy may be due to the patient's failure to take antibiotics as prescribed (i.e. non compliance). Persistent AFB positive results may also be due to the extent of the lung infection when TB was diagnosed and antibiotic therapy was initiated. Delayed diagnosis, resulting in extensive lung cavitation, may require more time for antibiotic therapy to resolve the infection. The case manager should initiate the evaluation of the patient and notify his/or supervisor within 24 hours. The case manager should also:

1. Review and confirm the patient's compliance with prescribed antibiotic therapy.
2. Place the patient on DOT, if not already on DOT.
3. Reconfirm that appropriate antibiotic therapy was prescribed and was based on antibiotic drug susceptibility testing and other considerations.

4. If additional anti-tuberculosis drugs are to be prescribed, that at least two new drugs not previously prescribed are added to the new drug regime.
5. Consider serum drug levels and potential for patient's drug intolerance.
6. Repeat AFB slide, culture and antibiotic susceptibility testing.

NOTE: If cultures continue to produce viable *M.tuberculosis* after 90 days, MDCH will automatically repeat antibiotic susceptibility testing. If an evaluation of therapy indicates that resistance has developed or secondary antibiotics may be required for a change in therapy, call the MDCH TB laboratory at 517-335-9636 or 517-335-9637 and request that susceptibility testing be performed earlier than 90 days.

No Culture Confirmation of Suspected Diagnosis of Tuberculosis

For patients diagnosed with tuberculosis but without confirmation based upon lab testing, due to negative AFB slide and culture results or failure to collect specimens for laboratory confirmation:

1. Review the medications that the patient was on at the time that TB medications were started, particularly other antibiotics.
2. Obtain follow-up chest radiograph reports to monitor clinical improvement.
3. Review patient symptoms to monitor clinical improvement.
4. Review TB skin test status and schedule repeat testing if initial skin test was negative or if skin testing was not done initially. Discuss with provider.
5. Review provider information regarding reasons for continuing TB therapy.
6. Discuss the findings from a review of the case and contact MDCH TB Epidemiology at 517-335-8165 to determine if the patient is to be reported as a case, and complete an RVCT.
7. Consider collecting specimens to be sent to MDCH to confirm a diagnosis of tuberculosis.

Verification of TB Drug Susceptibility Results

The case manager should obtain and promptly document all AFB slide, culture and susceptibility laboratory results. Thoroughly check patient records and determine all sources of a laboratory test results, i.e. all laboratories which have performed testing pertaining to the case.

1. If the patient's TB organism is pan-sensitive, continue to follow the recommended treatment regime as prescribed.
2. If the patient's TB organism is drug resistant,:

- a. Consult with the provider to confirm that currently prescribed drug therapy is appropriate.
 - b. If currently prescribed drug therapy is not appropriate, immediately notify the clinician to change the treatment regime to achieve an appropriate therapy.
 - c. Initiate DOT.
3. If resistant to isoniazid or multidrug resistant TB (MDR-TB):
- a. Place contacts on an appropriate regime for latent TB infection (LTBI) treatment. Treatment of LTBI caused by drug-resistant organisms should be provided by, or in close consultation with an expert in the management of more complicated TB cases.
 - b. Contact the MDCH TB Control Program at 517-335-8165 for consultation regarding treatment of drug-resistant TB.

Multidrug-Resistant Tuberculosis

If a patient has MDR-TB, the case manager should:

- 
1. Notify his or her supervisor and the patient's provider the same day that MDR-TB findings are reported or discovered.
 2. Confirm initiation of an appropriate regimen **within** 24 hours. If the provider is unwilling to institute an appropriate regimen, notify the case manager's supervisor and the MDCH TB Control Program at 517-335-8165 on the same day so they can intervene with the provider.
- 
3. For consultation regarding the treatment of drug-resistant TB, contact the MDCH TB Control Program at 517-335-8165.
 4. Initiate transfer of patient care to a more appropriate or experienced provider, if necessary. The case manager, in conjunction with the MDCH TB clinician and TB Control Program, should confer with the provider and arrange transfer of the case to a provider with experience/expertise in the management of MDR-TB. The case manager must document transfer of care and ongoing follow-up.
 5. Obtain appropriate medications from suppliers.
 6. Initiate DOT and maintain accurate DOT records. If the patient is non-adherent with DOT, the case manager must document attempts to correct the situation and notify his or her supervisor.
 7. Provide the following for patients with MDR-TB:
 - a. Patient education, including information regarding second-line TB drugs
 - b. DOT at the patient's convenience
 - c. Incentives and enablers

- d. Legal orders as warranted and if less-restrictive options have been exhausted



For more information, refer to the Patient Education section and topics in this section on “Directly Observed Therapy, Incentives and Enablers” and “Legal Orders.”

Clinical Response to Treatment

The case manager should monitor/evaluate a patient’s clinical response to treatment. The following are indicators of a patient’s clinical response to treatment:

1. Lessening or resolution of TB symptoms
2. Weight gain
3. Progressive improvement in the chest radiograph (if pulmonary TB disease is diagnosed and repeat radiographs are ordered)

Isolation

If a patient is isolated, ensure and document the patient’s adherence to respiratory isolation.⁵⁹



For more information on isolation and quarantine, refer to the Infection Control section.

Closing a Case

If the patient is not to be reported as a case, notify the provider that the patient is closed to TB control program services. The patient can be closed to TB Registry.



For more information on closing a case, see the “Completion of Therapy” topic in this section.

Completion of Therapy

The case manager should verify completion of therapy. Completion of therapy is essential to ensure that the patient is cured, and it is a goal of MIACET, the MDCH TB Control Program and CDC that all patients will complete an appropriate course of therapy within 12 months (where indicated). Verification of completion of therapy and a completed contact investigation are the responsibility of the case manager.



To record verification and closure information, fill out pages 6 and 7 of the TB case report form available on the Michigan Disease Surveillance System at <https://sso.state.mi.us/>.

Verifying Adequate Course of Treatment

Most cases of active TB can be successfully treated using the standard short course (six months) of therapy. The case manager is responsible for considering the following conditions to ensure that the patient has received an adequate course of therapy.

- **Culture remains positive beyond two months of treatment:** Reasons for persistent positive cultures should be examined and treatment adjusted/prolonged.
- **For TB involving the bones or joints or tuberculous meningitis:** These are exceptions to the standard six-month course. See “Duration of Treatment” in the “Treatment Regimens and Dosages” topic in the Treatment of Tuberculosis Disease section.
- **HIV-negative, culture-negative patients:** See “Duration of Treatment” in the “Treatment Regimens and Dosages” topic in the Treatment of Tuberculosis Disease section.
- **Relapse of TB following treatment for TB with pan-susceptible organisms:** Treatment may be prolonged to nine months or more. Current drug susceptibility testing must be performed and the regimen adjusted if resistance has developed.⁶⁰

Calculating Completion of Therapy

Base the determination of completion of treatment on the number of doses of directly observed therapy (DOT) received within the specified time frame.⁶¹ This will also assure that doses missed due to nonadherence or other treatment interruptions are still given after treatment is resumed.



For the total number of doses recommended for completion of regimens using first-line drugs, refer to the “Treatment Regimens and Dosages” topic in the Treatment of Tuberculosis Disease section.

Closures Other than Completion of Therapy

- **Moved:** All attempts should be made by the case manager to obtain the new or forwarding address. If this new address is within the original jurisdiction, the case should be transferred, as per the local public health agency protocol. If the new address is in another jurisdiction, the MDCH TB Program and the new jurisdiction should be notified and procedures followed as described in the Transfer Notifications section. Cases should be closed as “moved” only if a new address is obtained.



For information on whom to alert when a case will move or has moved, refer to the Transfer Notifications section.

- **Not TB:** If the completed diagnostic evaluation determined that the diagnosis of TB is not substantiated and another diagnosis is established, the case is closed as “Not TB.” Alternately, an initial diagnosis of TB may be refuted by laboratory testing that fails to identify *M. tuberculosis* complex in culture.
- **Lost:** If all attempts to locate the patient fail, the case should be closed as “Lost.”
- **Died:** If the patient expired prior to completion of therapy, the case is closed as “Died.”⁶²



Ensure that the contact investigation on the case is also completed. For more information, see the Contact Investigation section.

Evaluation

Evaluate case management activities. Patient care is never complete without the evaluation component. In tuberculosis (TB) case management, the achievement of desired outcomes must be evaluated so that services and activities can be improved and TB treatment goals achieved. Evaluation is the outcome of the case management process and should be continuous and ongoing.

Evaluation activities answer the following questions:

- Were the TB treatment plan and control activities implemented in a timely manner?
- Were intermediate and expected outcomes achieved?
- Was the patient satisfied with services or care?
- Were the case manager and the team members satisfied with the plan and outcomes?

Evaluation Activities

To evaluate case management, perform the following activities:

- Monitor the multidisciplinary care plan at least monthly.
- Identify strengths or weaknesses in the healthcare system.
- Conduct a cohort analysis at least every 3 months if your health department serves an average of two or more patients per month, or you have 5 or more active cases in a 3-month period. For health departments with fewer active cases, conduct a cohort review every 6 months.
- Monitor reports.

Monitor the treatment plan at least monthly or more frequently, depending on the complexity of treatment and patient variables. Review the appropriateness of interventions, as well as dates when intermediate and/or expected outcomes were achieved. Pay attention to how rapidly the treatment plan was changed when the need was identified. If the treatment plan has remained unchanged, determine the reason why.⁶³

Identify strengths or weaknesses in the healthcare system that negatively or positively affect the expected outcome. A good evaluation will lead to positive changes for the patient and others.

Conduct a cohort analysis to identify variances or common elements among the group. Cohort review is a “systematic review of the management of TB patients with TB disease and their contacts.”⁶⁴ With the information learned from the evaluation, the case manager can make changes to improve patient care outcomes.⁶⁵

Monitor reports to ensure that the TB case reports are accurate and updated according to state standards and that the contact investigation is complete.⁶⁶

Directly Observed Therapy

Provide directly observed therapy (DOT), as required. DOT means that a healthcare worker or other designated individual trained by the local health jurisdiction watches the patient swallow every dose of the prescribed TB drugs (“supervised swallowing”). A family member should not be designated to observe therapy. A dose of medication that is delivered to a patient, an address, or a mailbox or left with a family member, friend, or acquaintance is a dose of self-administered therapy (SAT) and should be designated as such.

DOT is a component of case management that helps to ensure that patients receive effective treatment and adhere to it. The American Thoracic Society (ATS), the Centers for Disease Control and Prevention (CDC), MIACET and MDCH recommend that every tuberculosis (TB) patient be considered for DOT.⁶⁷ DOT is implemented for the following reasons:

- DOT is the most effective strategy for making sure that patients take their medicines.
- DOT can lead to reductions in relapse and acquired drug resistance.⁶⁸
- Directly observing each dose provides immediate information on poor adherence and adverse effects, information that cannot readily be obtained from patients treated with SAT.

Candidates for Directly Observed Therapy

DOT is the standard of care in Michigan. That is, it is the goal to place all patients on DOT regardless of the patient’s circumstances because it has been shown to be such an important treatment tool.⁶⁹ Consider DOT for all patients with TB disease, and *ensure* that medications are delivered by DOT for the following patients:

- All patients initially, until treatment response determined
- Patients on intermittent regimens
- Pediatric patients with tuberculosis (TB) disease
- Patients with multidrug-resistant TB (MDR-TB)
- Persons with human immunodeficiency virus (HIV) coinfection and on treatment for latent TB infection (LTBI)
- Immunocompromised persons on treatment for LTBI
- Pediatric contacts on treatment for LTBI
- Household contacts on treatment for LTBI

How to Deliver Directly Observed Therapy

Who Can Deliver Directly Observed Therapy?

- Usually TB clinic personnel, such as a nurse or other healthcare worker
- Staff at other healthcare settings, such as outpatient treatment centers
- Other responsible persons, such as school personnel, employers, others trained by the local health jurisdiction
- *Not* family members⁷⁰

Principles of Directly Observed Therapy

- The healthcare worker should watch the patient swallow each dose of medication.
- Use DOT with other measures to promote adherence.
- DOT can be given anywhere the patient and healthcare worker agree upon, provided the time and location are convenient and safe.^{71,72}

Directly Observed Therapy Tasks

1. Deliver medication.
2. Check for side effects and adverse reactions.



For more information, see the “Ongoing Assessment and Monitoring” topic in this section and the “Side Effects and Adverse Reactions” topic in the Treatment of Tuberculosis Disease section.

3. Verify medication.
4. Watch the patient take pills.



Healthcare workers should watch for tricks or techniques some patients may use to avoid swallowing medication, such as hiding pills in the mouth and spitting them out later, hiding medicine in clothing, or vomiting the pills after leaving the clinic.

If it is necessary to make sure that the patient swallows the pills, the healthcare worker may have to check the patient’s mouth, or ask the patient to wait for a half hour before leaving the clinic so the medication can dissolve in the patient’s stomach.⁷³

5. Document the visit.
6. As necessary and appropriate, do the following:
 - a. Provide patient education.
 - b. Help the patient keep appointments.
 - c. Connect the patient with social services and transportation.
 - d. Draw upon familiarity with the patient's home environment to identify household contacts.
 - e. Offer incentives and/or enablers to encourage adherence.⁷⁴



For more information, refer to the Patient Education section and the “Incentives and Enablers” topic in this section.

Adherence to Directly Observed Therapy

Patient Education

The case manager should ensure that education is provided in the patient's primary language and is culturally appropriate.⁷⁵



For more information, see the Patient Education section. For points to use to explain to the patient why DOT is important, refer to the CDC's *Questions and Answers About TB 2005. Active TB Disease: What is directly observed therapy?* (Division of Tuberculosis Elimination Web site; 2005) at this hyperlink: http://www.cdc.gov/tb/faqs/qa_TBdisease.htm .

Children with Tuberculosis

To facilitate DOT adherence of children with TB, the case manager needs to be familiar with the childhood developmental stages, including important events, and utilize strategies in consideration of these stages.



For more information on adherence strategies for different developmental stages, see Appendix C in the New Jersey Medical School National Tuberculosis Center's *Management of Latent Tuberculosis Infection in Children and Adolescents: A Guide for the Primary Care Provider* (New Jersey Medical School Global Tuberculosis Institute Web site; 2004) at this hyperlink: <http://www.umdnj.edu/globaltb/downloads/products/PediatricGuidelines.pdf> .

Agreements

It may be useful to develop a letter of agreement or acknowledgment between the patient and the DOT worker. Some jurisdictions have successfully used these as a method of ensuring adherence to therapy. The DOT worker and the patient negotiate dates, places, and times for DOT services to be provided, and both sign a document stating such agreements. Included in the agreement could be language specifying what consequences may result in the event that the client violates the terms of the contract.⁷⁶

Incentives and Enablers

Incentives and enablers are often appropriate to help patients adhere to DOT.



For more information, see the “Incentives and Enablers” topic in this section.

Missed Directly Observed Therapy Dose



If a DOT dose is missed, the patient should be contacted on the same day or on the next business day and the issue escalated to the case manager’s supervisor.

It is important not to send a mixed message to patients by delaying the response to missed DOT doses. After educating patients on the importance of TB treatment to themselves, their contacts and their community, the case manager must enforce this importance by responding immediately to a missed DOT doses.

A missed dose needs to be seen as an opportunity to identify barriers to adherence and work with patients to find ways to successfully complete treatment. The key to a successful DOT program is the use of immediate information on poor adherence, side effects, and adverse reactions in order to promptly identify and respond to potential barriers to adherence, missed doses, and potential adverse treatment effects. This approach has been referred to as enhanced DOT—the use of a patient-centered approach to promptly identify and address barriers to treatment completion through use of incentives, enablers, and education efforts appropriate to the individual patient.

Incentives and Enablers

Use incentives and enablers to enhance adherence to therapy.⁷⁷ Incentives and enablers are used to improve patient attitudes and to foster good health behaviors.⁷⁸ They help patients stay with and complete treatment.⁷⁹

Incentives are small rewards given to patients to encourage them to either take their own medicines or keep their clinic or field directly observed therapy (DOT) appointments.⁸⁰ **Enablers** are things that make it possible or easier for patients to receive treatment by overcoming barriers such as transportation difficulties.

Table 1: EXAMPLES OF POSSIBLE INCENTIVES AND ENABLERS

Incentives	Enablers
<ul style="list-style-type: none">▪ Food and beverages▪ Clothing▪ Automotive supplies▪ Hobby/craft items▪ Household items▪ Laundry services▪ Seasonal/holiday treats▪ Movie passes▪ Restaurant/fast food vouchers▪ Toys▪ Personal care items	<ul style="list-style-type: none">▪ Transportation<ul style="list-style-type: none">• Bus pass• Cab fare• Battery for patient's car• Gas• Fee for driver's license▪ Childcare▪ Obtaining and transporting specimens for the patient▪ Assisting the client to get medication refills▪ Rent assistance▪ Assisting the client to complete paperwork to get food/housing assistance▪ Assisting the client to get substance treatment



To obtain incentives and enablers, contact Katie Dotson, TB Nursing Specialist at 517-335-8165.

Legal Orders



For Michigan laws and rules on tuberculosis (TB), see the following:

- Michigan Communicable Disease Rules at http://www.state.mi.us/orr/emi/admincode.asp?AdminCode=Single&Admin_Num=32500171&Dpt=CH&RngHigh=.
- Michigan Public Health Code, chapter 333, sections 2451, 5117, 5203, 5205, 5207, 5301 at [http://www.legislature.mi.gov/\(S\(0csese55a40opq55wag2vp3e\)\)/mileg.aspx?page=getObject&mcl-Act-368-of-1978](http://www.legislature.mi.gov/(S(0csese55a40opq55wag2vp3e))/mileg.aspx?page=getObject&mcl-Act-368-of-1978).

It is important to understand when and how to use legal orders, if necessary, to promote or assure adherence to therapy. There are many factors that may motivate or contribute to a patient's non-adherence. Each patient must be considered individually, and interventions to overcome non-adherence must be customized to the patient, including the use of legal obligation if necessary. It is the local public health department's responsibility to ensure that compliance is maintained, treatment is completed, and the risk of transmission to others is eliminated, and the MDCH TB Control Program will provide support and guidance to local health departments in achieving these responsibilities. Public health staff must exhaust all reasonable and less-restrictive options to achieve the responsibilities above, before resorting to legal action.⁸¹

Progressive Interventions

Have an intervention plan that goes step-by-step from voluntary participation to involuntary confinement as a last resort. Refer to Figure 1: **Progressive Interventions for Nonadherent Patients**. Progressive intervention should begin with learning the possible reasons for nonadherence and addressing the identified problems using methods such as directly observed therapy (DOT), incentives, and enablers. The patient should be told orally and in writing of the importance of adhering to treatment, the consequences of failing to do so, and the legal actions that will have to be taken if the patient refuses to take medication.⁸² Before legal measures are taken against a patient who has been taking TB drugs on a self-administered basis, DOT should be offered to the patient.⁸³

Use a DOT agreement form and home isolation form with a patient who is likely to comply with treatment requirements. With a patient who may need more encouragement to adhere to treatment, complete a voluntary orders form. Voluntary orders are not legal orders but serve to clarify the mutual understanding between the patient and the local public health agency and provide written proof that treatment requirements were communicated to the patient and that the patient agreed to them.

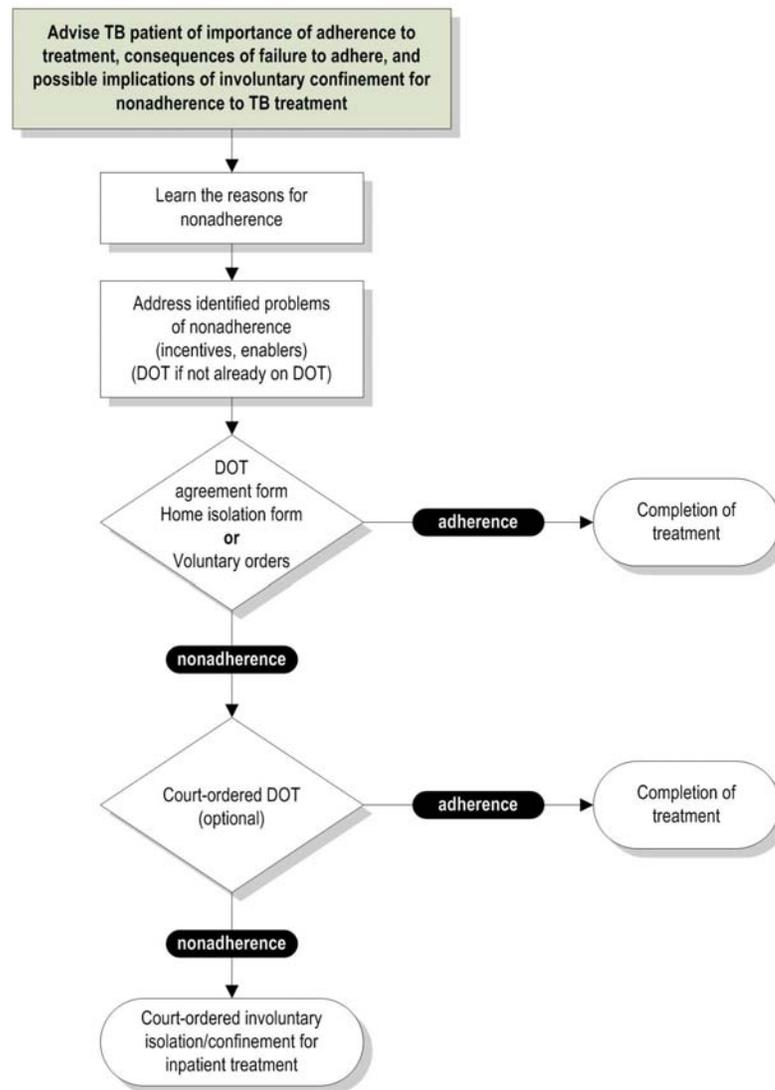


Templates for a variety of legal orders pertinent to TB control at the local level are available in the TB Nurse Network Toolkit and online at <http://www.michigantb.org/hcp/tool.asp>.

If the patient does not adhere to DOT voluntarily, the next step may be court-ordered DOT. An optional step toward other legal orders, court-ordered DOT can be successful in convincing a patient that his or her TB treatment is an important public health priority. Involuntary confinement or isolation for inpatient treatment should be viewed as the step of last resort, to be used only when all other options fail. However, when a patient with infectious TB refuses treatment and voluntary isolation, emergency detention to isolate the person is appropriate.⁸⁴ For consultation on the types of orders that may be employed to manage a difficult patient, and how to serve them, call the MDCH TB Control Program at 517-335-8165.

Under normal circumstances, patients with extrapulmonary TB do not transmit the disease to others, and, therefore, these persons usually cannot be legally ordered to take their medications. However, their personal health is endangered if they choose not to be treated. They should be educated regarding the possibility of their disease spreading to the lungs and becoming infectious to others.

Figure 1: PROGRESSIVE INTERVENTIONS FOR NONADHERENT PATIENTS⁸⁵



Definitions of abbreviations: DOT = directly observed therapy; TB = tuberculosis.

Source: CDC. Module 9: Patient Adherence to Tuberculosis Treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:28.



Criteria for starting and discontinuing isolation are provided in the Infection Control section.

Resources and References

General Case Management Resources

- CDC. Module 4: “Treatment of Tuberculosis Infection and Disease” (*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.
- CDC. Module 9: “Patient Adherence to Tuberculosis Treatment” (*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist
- California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). “TB Case Management—Core Components” (*CDHS/CTCA Joint Guidelines* [CTCA Web site]; May 11, 1998). Available at: <http://www.ctca.org/guidelines/IIA6casemgmt.pdf> .
- New Jersey Medical School National Tuberculosis Center. *Tuberculosis Case Management for Nurses: Self-Study Modules* (New Jersey Medical School Global Tuberculosis Institute Web site). Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm>

Directly Observed Therapy Resources

- CDC. Chapter 7: “Treatment of TB Disease” (*Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]; Updated November 2001). Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm
- CDC. Module 9: “Patient Adherence to Tuberculosis Treatment” (*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist
- Francis J. Curry National Tuberculosis Center. *Directly Observed Therapy (DOT) Training Curriculum for TB Control Programs* (Francis J. Curry National Tuberculosis Center Web site; 2003). Available at: <http://www.nationaltbcenter.ucsf.edu/catalogue/epub/index.cfm?uniqueID=1&tableName=DOTE> .

Incentives and Enablers Resources

- CDC. “Adherence” in Chapter 7 “Treatment of TB Disease” (*Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]; Updated November 2001). Available at: http://www.cdc.gov/tb/publications/Cont_Core_Curr_Course.htm

- CDC. Module 9: “Patient Adherence to Tuberculosis Treatment” (*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist

Legal Orders Resources

- CDC. Module 9: “Patient Adherence to Tuberculosis Treatment “(*Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]; 1999). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist .
- New Jersey Medical School National Tuberculosis Center. *Implementing Legal Interventions for the Control of Tuberculosis* (New Jersey Medical School Global Tuberculosis Institute Web site; 2005). Available at: <http://www.umdnj.edu/globaltb/products/legalinterventions.htm> .
- State of Washington Department of Health. *Tuberculosis Program* [Web page] (Washington State Department of Health Website; July 2008). Available at: <http://www.doh.wa.gov/cfh/tb/default.htm> .

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):32.
- ² CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:3. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):14.
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):17.
- ⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):17.
- ⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):1.
- ⁷ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):1–2.
- ⁸ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):1–2.
- ⁹ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ¹⁰ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ¹¹ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ¹² New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ¹³ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ¹⁴ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.

-
- ¹⁵ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ¹⁶ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ¹⁷ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):8. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ¹⁸ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):25.
- ¹⁹ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):9. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁰ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):9. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²¹ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):9. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²² New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):9. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²³ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):16. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁴ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):9. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁵ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):10. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):1–2.
- ²⁷ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):10. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁸ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):10. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ²⁹ Virginia Department of Health Division of Tuberculosis Control. *Virginia Tuberculosis Control Laws Guidebook* [Virginia Department of Health Web site]. 2001:22. Accessed July 11, 2006.
- ³⁰ Virginia Department of Health Division of Tuberculosis Control. *Virginia Tuberculosis Control Laws Guidebook* [Virginia Department of Health Web site]. 2001:22, 31; New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):26–27. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ³¹ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):14. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ³² New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):14. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.

-
- ⁴⁸ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):11. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁴⁹ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):15. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁵⁰ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):11. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁵¹ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):16. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁵² New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):16. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁵³ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):12. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁵⁴ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ⁵⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ⁵⁶ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):43.
- ⁵⁷ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ⁵⁸ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:9. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ⁵⁹ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:10–12. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ⁶⁰ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:17–18. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ⁶¹ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52 (No. RR-11):3.
- ⁶² California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). TB case management—core components. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. May 11, 1998:17–18. Available at: <http://www.ctca.org/guidelines/index.html> . Accessed July 11, 2006.
- ⁶³ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):19. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁶⁴ Charles P. Felton National Tuberculosis Center. *Cohort Review Instruction Guide*. New York: NY 2005:1.
- ⁶⁵ New Jersey Medical School National Tuberculosis Center. Module 2: Fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* (no year):19. Accessed July 11, 2006.
- ⁶⁶ New Jersey Medical School National Tuberculosis Center. Module 2: fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* [New Jersey Medical School Global Tuberculosis Institute Web site]. (no year):19. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm> . Accessed July 11, 2006.
- ⁶⁷ Francis J. Curry National Tuberculosis Center. Session 1 participant's workbook. *Directly Observed Therapy Training Curriculum for TB Control Programs* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA: 2003:1–5. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-07 . Accessed July 11, 2006.
- ⁶⁸ CDC. Training Slide 70: directly observed therapy (DOT). *Core Curriculum on Tuberculosis* (2000) Slide Set [Division of Tuberculosis Elimination Web site]. Available at: <http://www.cdc.gov/tb/pubs/slidesets/core/default.htm> . Accessed July 11, 2006.
- ⁶⁹ Burman WJ, Reves RR. How much directly observed therapy is enough? *Am J Respir Crit Care Med* 2004;170:474.

-
- ⁷⁰ Francis J. Curry National Tuberculosis Center. Session 1 participant's workbook. *Directly Observed Therapy Training Curriculum for TB Control Programs* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA: 2003:1–7. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-07. Accessed July 11, 2006.
- ⁷¹ CDC. Training Slide 70: directly observed therapy (DOT). *Core Curriculum on Tuberculosis (2000) Slide Set* (Division of Tuberculosis Elimination Web site). Available at: <http://www.cdc.gov/tb/pubs/slidesets/core/default.htm>. Accessed July 11, 2006.
- ⁷² CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:16. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁷³ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:16. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁷⁴ Francis J. Curry National Tuberculosis Center. Session 1 participant's workbook. *Directly Observed Therapy Training Curriculum for TB Control Programs* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA: 2003:1–7. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-07. Accessed July 11, 2006.
- ⁷⁵ New Jersey Medical School National Tuberculosis Center. Module 2: Fundamentals of TB case management. *Tuberculosis Case Management for Nurses: Self-Study Modules* (no year):12. Available at: <http://www.umdnj.edu/globaltb/products/tbcasemgmtmodules.htm>. Accessed July 11, 2006.
- ⁷⁶ Francis J. Curry National Tuberculosis Center. Session 1 participant's workbook. *Directly Observed Therapy Training Curriculum for TB Control Programs* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA: 2003:1–9. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=EDP-07. Accessed July 11, 2006.
- ⁷⁷ CDC. Adherence. In: Chapter 7: treatment of TB disease. *Core Curriculum on Tuberculosis (2000)* [Division of Tuberculosis Elimination Web site]. Updated November 2001. Available at: <http://www.cdc.gov/tb/pubs/corecurr/index.htm>. Accessed July 11, 2006.
- ⁷⁸ National Tuberculosis Controllers Association, National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care*. Atlanta, GA: 1997:82–83.
- ⁷⁹ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁸⁰ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁸¹ National Tuberculosis Controllers Association, National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care*. Atlanta, GA: 1997:55–56.
- ⁸² CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:28. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁸³ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:28. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁸⁴ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:28. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.
- ⁸⁵ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:28. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm>. Accessed July 11, 2006.

Patient Education

CONTENTS

Introduction.....	10.2
Purpose.....	10.2
Policy	10.3
State Laws and Regulations	10.3
Materials and Resources	10.3
General Guidelines	10.4
Language and Comprehension	
Barriers	10.5
Education Topics.....	10.6
Medical diagnosis	10.6
Contact investigation.....	10.7
Isolation.....	10.7
Side effects and adverse reactions.....	10.8
Adherence.....	10.8
Assessment for Patient Adherence or Difficulty..	10.9
Patient Education Materials.....	10.14
Resources and References	10.15

Introduction

Purpose

Use this section to do the following:

- Determine what information to cover in education sessions.
- Educate patients about tuberculosis (TB) generally.
- Educate patients about latent TB infection (LTBI) and active disease, and the differences between them.
- Identify which forms to use to document education efforts.

An important part in helping patients to adhere to treatment plans is to educate them about TB. This means talking to them about what causes TB, the way TB is spread, how TB is diagnosed, and their specific treatment plan.¹ Patients cannot be expected to adhere to treatment recommendations if they are not educated about TB and how it is treated, and patients who understand these concepts are more likely to adhere to treatment.

Patients with LTBI need to understand that they are infected with TB, that they may have specific risks for progressing to TB disease, and that they can take precautions to protect themselves, their family, and their friends. Patients with TB disease need to understand the seriousness of the disease and why it is important to adhere to treatment. In order to prevent relapse and drug resistance, clinicians must prescribe an adequate regimen and make sure that patients adhere to treatment.² To ensure completion of treatment, the public health department should thoroughly educate the patient, monitor the patient's adherence, and use incentives and enablers.^{3,4,5}

Patient education is often a long process, and can consume a great deal of time and resources. Be prepared to repeat some or all of the educational process with the patient and their family or friends, using a variety of mediums and styles to enhance their understanding and acceptance. Many patients, especially those with cultural or linguistic barriers, will require supplemental or review encounters to achieve complete understanding and acceptance of their disease or infection status, and their treatment plan. The patient's family or close social network can be key sources of support and guidance for the patient. Thus, educating these people is another way of ensuring that all parties understand and accept the patient's status and treatment plan. This can be especially true of foreign-born patients, who frequently seek extensive support from within their own familial or social-ethnic groups. Do not expect to succeed on the first few encounters with any patient. Be prepared to invest a long-term effort in building a positive relationship with the patient, whereby they grow to feel comfortable in exchanging information with you.

Policy

Local health departments determine the content for TB education that is provided to patients with TB disease and LTBI. The MDCH TB Control Program recommends local health departments to use this manual to assist in designing educational materials for use in their communities.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

Local health departments are empowered under the Michigan Health Code (333.5201 & 333.5203) to provide education as necessary to persons with confirmed or suspected tuberculosis disease or LBTI.

Materials and Resources



Recommended educational materials and resources are available on the website of the Michigan Advisory Council for Elimination of Tuberculosis at <http://www.michigantb.org/hcp/tool.asp>. Select the appropriate topic under the “Education Section” tab.

The MDCH TB Control Program recommends retention of education materials shared and discussed with the patient in the patient’s chart, as well as the date when such materials were discussed with the patient. Also, local health departments should maintain a list of local resources for referral of patients. For example, a list identifying referral options for substance abuse rehabilitation/recovery, psychiatric counseling or treatment, social service or work-assistance programs. Local health departments hold primary responsibility for making referrals as needed to promote a patient’s adherence to treatment.

General Guidelines

Table 1: GUIDELINES FOR THE EDUCATIONAL PROCESS

When Educating Tuberculosis Patients	
Do	Don't
<ul style="list-style-type: none">▪ Find out what patients know and believe about tuberculosis (TB). Reinforce and provide correct TB information, and disabuse them of any misconceptions.▪ Use good skills to interview and influence patients and to problem solve.▪ Go through the educational material with patients. Use language appropriate to their level of understanding. If necessary, use an interpreter.	<ul style="list-style-type: none">▪ Flood patients with information about TB and its effects without allowing them to participate in the discussion.▪ Hand out pamphlets and brochures to patients without going through the materials with them.

Language and Comprehension Barriers

In the initial assessment, assess for and address any potential language and comprehension barriers.

1. Assess the patient's ability to speak and understand instructions, including potential barriers, such as not speaking English as primary language, deafness, speech deficit, or learning disability.
2. Assess literacy in the patient's primary language.
3. Provide all instructions and communications in the appropriate language.
4. Use interpreters, visuals, or other educational methods to promote understanding.
5. Provide educational materials appropriate to the patient's language and reading level.
6. Make referrals to an appropriate service and notify it of any language and comprehension concerns.



For more information on cultural sensitivity, refer to the *Participant's Workbook* for Session 4: "Working with Culturally Diverse Populations" in the *Directly Observed Therapy Training Curriculum for TB Control Programs* (Francis J. Curry National Tuberculosis Center Web site; 2003) at this hyperlink:

<http://www.nationaltbcenter.ucsf.edu/catalogue/epub/index.cfm?uniqueID=2&tableName=DOTE> .

Click on "Trainer's Guide", then "Section 4". Also review "Participants Workbook", then "Session 4".



For assistance with language issues, see the *Language Services Resource Guide for Health Care Providers* (The National Health Law Program Web site; 2006) at this hyperlink:

<http://www.healthlaw.org/library/item.118835>. References and contact information for translation services in Michigan can be found through this reference. Note that this file may download slowly.

A list of resources for non-English patient education materials is also available through the website of the Michigan Advisory Committee for Elimination of Tuberculosis at <http://www.michigantb.org/hcp/tool.asp>. Under the "Education Section" tab select link 4, Multi-language TB Educational Materials.

Education Topics

During the initial assessment, directly observed therapy (DOT) appointments, and monthly monitoring, educate the patient as needed on the topics that follow..

Medical Diagnosis

In the initial interviews with the patient, provide information about TB and the patient's treatment plan. During DOT appointments and monthly monitoring, confirm and reinforce the patient's understanding of these topics.

1. Discuss the difference between TB disease and TB infection.
2. Explain the signs and symptoms of TB, how TB is transmitted, ways to prevention transmission, and treatment.
3. Explain that TB is both treatable and preventable.
4. Explain the importance of completing treatment.
5. Discuss diagnostic procedures used to make or confirm a diagnosis of TB, such as chest radiography, sputum microscopy, and tuberculin skin testing. Stress the importance of testing and follow-up.
6. Discuss the current medical treatment plan and rationale. MDCH TB Control Program recommends that all patients be required to sign the treatment plan and a DOT agreement.
7. Explain the need for regular medical monitoring and follow-up during the disease process. Discuss how treatment will be monitored (i.e., sputum, blood tests, vision screening, weight check, etc.). Encourage the patient to be an active participant in their own care and treatment.
8. Discuss the roles of the patient (engage in treatment), the health department (case management, monitoring, contact tracing, and supervision of treatment), and the private provider (treatment and monitoring). Encourage the patient to contact the case manager immediately for any issues and problems that arise during treatment. Reinforce with the patient that the case manager and the local health department are responsible to make sure that any problems or difficulties during treatment are addressed.
9. Explain the risks of treatment relapse or failure (i.e., prolonged disease and discomfort, prolonged transmission to others, development of drug resistance) and the need to complete treatment to prevent relapse.
10. Explain the signs and symptoms of possible relapse or failure and encourage the patient to report them immediately to the case manager.

Contact Investigation

When a contact investigation is necessary, educate the index patient about the process and confidentiality.

1. Discuss the contact investigation process.
2. Reinforce the confidentiality of investigation, but warn the patient of the potential for contacts to guess the patient's identity. Review with the patient your health department's policies regarding a patient's right to notify their own contacts. Discuss the potential benefits and risks of notifying their own contacts versus having the health department notify them.



For more information, see *Effective TB Interviewing for Contact Investigation: Self Study Modules* (Department of Health and Human Services Centers for Disease Control and Prevention Division of Tuberculosis Elimination Web site; 2006) at this hyperlink:
http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

Isolation

If isolation is necessary, educate the patient about how to take proper precautions.

1. Explain isolation precautions and restrictions, if appropriate. MDCH TB Control Program recommends that all patients placed in isolation be required to sign an isolation agreement.
2. Explain the behavior changes needed for infection control. Discuss permitted and prohibited activities, limiting and excluding visitors, covering the mouth and nose when coughing and sneezing, and using a mask. Discuss how certain contacts may be at higher risk for developing TB disease if exposed (i.e., children or immunosuppressed) and why special precautions must be used if the patient could encounter such people.
3. Explain the home environmental changes needed for infection control. Discuss ventilation and sunlight. Explain how to dispose of items soiled with potentially infectious material.
4. Discuss the requirements for release from isolation. Advise the patient that clearance is contingent upon clinical condition and continued compliance with the treatment regimen.

If a patient requires isolation at their home or another residential setting, refer to CDC's "Guidelines for Preventing Transmission of *M. tuberculosis* in Health-Care Settings, 2005", pp 26 – 27, pp 43 – 44, and the table on page 127; available at <http://www.cdc.gov/tb/publications/guidelines/infectioncontrol.htm>.

Side Effects and Adverse Reactions

Educate all patients receiving antituberculosis medications about the medications' potential side effects and adverse reactions.

1. Explain the names, dosages, and rationale for the drug treatment plan as well as the importance of treatment.
2. Explain the common side effects and methods to improve symptoms.
3. Explain signs and symptoms of drug toxicity.
4. Direct the patient on what actions to take if side effects or signs and symptoms of toxicity appear.
5. Explain potential effects of alcohol and/or drug use on treatment and the increased risk for side effects and toxicity.



For more information on side effects and adverse reactions, see the “Side Effects and Adverse Reactions” topics in the Treatment of Tuberculosis Disease section or the Treatment of Latent Tuberculosis Infection section.

Adherence

MDCH TB Control Program recommends that all patients receiving antituberculosis medication be educated about the importance of treatment, their responsibilities during treatment, and the consequences of nonadherence.

1. Explain the drug names and dosages and the rationale for the drug treatment plan.
2. Explain the importance of treatment and follow-up for active TB.
3. Explain the importance of regular monitoring visits.
4. Discuss the treatment plan and expectations. Advise the patient on the patient's responsibilities and expected behavior regarding treatment compliance and follow-up activities. Have the patient sign the treatment plan and a DOT agreement.
5. Advise the patient on Michigan's laws regarding TB disease and the responsibility and authority that local health departments have to control and treat TB disease. For example:
 - a. Local health departments are required to protect the health of people residing in their jurisdiction. This includes, if necessary, issuing instructions or restrictions to an individual or a group. (MCL 333.2451 & 333.5117)
 - b. Local health departments are required to treat people in their jurisdiction who have serious communicable diseases, including TB. (MCL 333.5117)
 - c. Local health departments are required to employ legal measures, if necessary, to accomplish these goals. Such measures may include verbal or written warnings or orders to individuals or groups, or court-ordered intervention such as education, isolation and treatment. (MCL 333.5203, 333.5205, 333.5207)

Assessment for Patient Adherence or Difficulty

The MDCH TB Control Program recommends that all patients being evaluated for TB disease or LTBI be assessed for potential adherence or compliance difficulties. Local health departments are encouraged to develop and utilize their own assessment tools, and the MDCH TB Control Program has developed two draft assessment tools based on difficult TB cases that have occurred in Michigan during recent years. "Staff Risk Assessment for Tuberculosis Patient Compliance and Adherence" is suggested for completion by public health staff, and "Patient Questionnaire for Tuberculosis Education" is suggested for completion by the patient. These forms may be used as they are or modified to suit your health department's needs.

Staff Risk Assessment for Tuberculosis Patient Compliance and Adherence

1. Name of Patient _____ 2. DOB _____
3. Alias _____ 4. Client ID# _____
5. Case Mgr: _____ 6. Agency _____
7. Patient Address _____
8. Telephone number(s) _____
9. Best way to contact or find patient if no phone is available:
Person _____ Phone # _____
10. Interviewer: _____ 11. Date: _____

Medical History and Past TB History

12. Patient currently taking TB medication? Yes No (Mark each med patient is taking)
 INH RIF Rifamate EMB PZA Other _____
13. Patient currently receiving DOT? Yes No
14. Is patient's employer aware of patient's TB status? Yes No
15. All *other* medications that patient currently takes and dosages

16. Previous history of TB disease? No Yes (year) _____
 pulmonary extra pulmonary _____
17. Previous treatment for TB disease? No Yes
18. Specify previous TB therapy, dates and dose, and prescribing physician/clinic:
 INH _____ RIF _____
 Rifamate _____ EMB _____
 PZA _____ Other _____
Physician/clinic & phone _____
19. Previous Hospitalization for TB? No Yes Discharge date: _____ AMA
20. Source of TB: family history: No Yes Unknown
Other exposure (relationship/date) _____

21. Current additional illness/medical conditions and diagnosis (dates)

22. Patient's current medical provider (name/address)? _____

23. Last time patient was seen (date) _____

24. HIV Screening test done? No Yes Positive Negative Unknown

Medical Referral Needed: Yes No **Agency/Dept:**

Date referred: _____ **Follow up needed?** Yes No **Frequency:**

Comments: _____

Preventive Health and Substance Abuse

25. Smokes cigarettes Yes No packs per day _____ #years _____

26. Smokes cigars Yes No # per day _____ #years _____

27. Chews tobacco Yes No times per day _____ #years _____

28. Alcohol use Never Yes (amt/frequency) _____ Quit _____

29. Street drug use Never Yes (type, frequency and duration of use) _____

Are these drugs having an effect on patient's life? Yes No

30. Does patient understand why they need to stop using drugs/alcohol during TB treatment? Yes No

31. Sexual activity: male female both multiple partners not sexually active

32. Safer sex practices: Birth control never rarely consistently

Condom never rarely consistently

33. Have you ever been told you have a learning disability or do you have difficulty understanding new information? _____

Preventive Health/Substance counseling referral Needed: Yes No

Agency: _____ **Date referred:**

Comments: _____

Psychosocial Status

34. Marital Status: Single Married Domestic Partner Divorced Separated
Widowed (year) _____
35. Housing: House/Own Apt/Rent Shelter Homeless Hotel
Other: _____
How long at this residence (days/months/years): _____
If transient or homeless, where does patient spend their evenings? _____
36. Source of Income: Employment (specify) _____ SSI
Unemployment None
37. Transportation: How do you get to clinic appointments? _____
Transportation Needs: Yes No
38. Clothing: Adequate Inadequate
39. Speaks English: Not at all Limited Fluent
Reads English: Not at all Limited Fluent
Writes English: Not at all Limited Fluent
40. Birthplace: US Other country (specify & date entered US) _____
41. Health care coverage: Uninsured/self pay SSI/Medicaid Private Ins
Other _____
42. Has a problem with healthcare: Yes No
Needs primary care provider: Yes No
43. Support from family: Financial Emotional Domestic
44. Family violence: Yes No Potential for violence: Yes No
45. Does client exhibit psychiatric/behavioral symptoms? Yes No
Specify _____
46. Would client need a psychiatric evaluation? Yes No

Psychiatric/Social Services Referral Needed: Yes No

Agency/Program: _____ **Date referred:** _____

Follow up recommended? Yes No **Frequency:** _____

Comments: _____

Adherence/Compliance

47. Client accepts dx: Yes No
48. Client understands TB disease process and treatment: Yes No
49. Family understand TB disease process and treatment: Yes No
50. Client is alert and able to care for self: Yes No

51. Client has disabilities: Yes No
52. Client needs assistance with: _____
53. Client is agreeable to DOT: Yes No DOT contract on file: Yes No
 Convenient time/place for DOT _____
54. Treatment Plan completed? Yes No
 Patient aware of Treatment plan? Yes No
 Date reviewed with client _____
55. Is client at risk for non-compliance? Yes No

Comments: _____

NOTE: The following questions in this form indicate potential risk factors for non-compliance or complication: 16, 17, 19, 28, 29, 35, 47, 53, 54, 55.

The following questions in the patient self-assessment form indicate potential risk factors for non-compliance or complication: 15, 16, 25, 26, 28, 29, 30, 33.

Patient Questionnaire for Tuberculosis Education

1. Name _____ 2. Date of Birth _____ 3. Phone _____
4. Address _____
5. What language do you read best? _____
6. What language do you speak best? _____
7. Do you have a job? Yes No
8. How many hours do you work per week? _____
9. Where do you work? _____ 10. What is your occupation? _____
11. Do you have medical benefits? Yes No
12. Do you have your own car? Yes No
13. If not, do you have money for a bus? Yes No
14. Were you born outside of the United States? Yes No
15. Are you comfortable discussing medical or health information in English?
Yes No
 If not, which language(s) would you prefer to use? _____
16. What is the best way for you to learn or talk about medical or health information?
Talking/Listening
Reading/writing
Both
17. Do you see a doctor regularly? Yes No
18. Do you have other medical conditions? Yes No What other medications do
 you currently take? _____

19. Have you had flu shots or pneumonia shots recently? Yes No
20. Are you in pain at this time? Yes No
21. Has your weight changed recently? Yes No
22. Have you had recent changes in your eating habits? Yes No
23. Have you ever been abused? Yes No
Are you being abused now? Yes No
24. Have you ever been tested for HIV? Yes No
25. Have you had TB disease before? Yes No
If yes, were you treated? Yes No
26. How well do you feel you understand TB? Very Well Some Not at all
27. Since you have been told you have TB, do you feel you could use more help?
Yes No
28. Please describe your TB treatment plan. _____
-
29. Please describe how you feel about your TB diagnosis and status. Sad Happy
Worried Shunned Fear Confused Ashamed No problem
-
30. Do you experience difficulty with any of the following skills or abilities?
Forget your name, address, or date
Following simple directions
Confused or get lost easily
31. Do you feel anxious? Yes No
32. Have you ever been told you have a learning disability? Yes No
33. Have you ever taken medications for depression? Yes No

Thank you for sharing this information. A nurse will meet with you to answer any questions and talk about other services that may help you, and how you can access them.

Sources for draft patient assessment forms:

City of New York TB Clinical Policies and Protocols, 4th Ed. Available at:

<http://www.nyc.gov/html/doh/downloads/pdf/tb/tb-protocol.pdf>

Waccamaw Public Health District, Myrtle Beach, SC. TB Nurses: 1986.

New Jersey Medical School, Global Tuberculosis Institute. *Performance Guidelines: A Supervisor's Guide to the Assessment and Development of Field Investigation Skills*. Available at:

<http://www.umdnj.edu/globaltb/productlist.htm>.

New Jersey Medical School, Global Tuberculosis Institute. *Performance Guidelines for Contact Investigation: The TB Interview*. Available at: <http://www.umdnj.edu/globaltb/productlist.htm>.

New Jersey Medical School, Global Tuberculosis Institute. *TB Interview Checklist*. Available at: <http://www.umdnj.edu/globaltb/productlist.htm>.

Patient Education Materials

The Centers for Disease Control and Prevention (CDC) offers a variety of patient education materials online at:

<http://www.cdc.gov/tb/publications/factsheets/default.htm>

<http://www.cdc.gov/tb/publications/pamphlets/default.htm>

<http://www.cdc.gov/tb/publications/CulturalMaterials.htm>

The Michigan TB Nurse Network has also assembled a variety of patient education materials. They are available for download through the web site of the Michigan Advisory Committee for Elimination of Tuberculosis at:

<http://www.michigantb.org/hcp/tool.asp>. We recommend downloading files to your computer for easier viewing (right-click on the desired link and then choose "Save As..."), rather than attempting to view the documents online.

Resources and References

Resources

Patient Education Information for Healthcare Workers

- CDC. “Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection” (*MMWR* 2000;49[No. RR-6]). Available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- ATS, CDC, IDSA. “Treatment of Tuberculosis” (*MMWR* 2003;52[No. RR-11]). Available at: <http://www.cdc.gov/tb/publications/guidelines/Treatment.htm>.
- CDC. *Self-Study Modules on Tuberculosis* (Division of Tuberculosis Elimination Web). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
 - Module 9: “Patient Adherence to Tuberculosis Treatment.”
 - Module 4: “Treatment of Tuberculosis Infection and Disease, Adherence to Treatment.”
- CDC. *TB Elimination: Now Is the Time! 2007* (Division of Tuberculosis Elimination Web site; 2007). Available at: <http://www.cdc.gov/tb/publications/pamphlets/default.htm>.

Patient Education Materials for Patients

- CDC. *TB Education and Training Resources* [TB Education and Training Resources Web site]. Available at: <http://www.findtbresources.org/scripts/index.cfm> .
- CDC, Division of Tuberculosis Elimination. *Education and Training Materials* [Division of Tuberculosis Elimination Web site]. Available at: <http://www.cdc.gov/tb/publications/pamphlets/default.htm>.
- Minnesota Department of Health. *Tuberculosis: Patient Education Materials* [Minnesota Department of Health Web site]. Available at: <http://www.health.state.mn.us/divs/idepc/diseases/tb/brochures.html> .
- University of Washington Harborview Medical Center. *Patient Education Resources: All Languages* [EthnoMed Web site]. Available at: <http://ethnomed.org/clinical/tuberculosis>.

References

- ¹ CDC. Module 4: treatment of TB infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- ² CDC. Module 4: treatment of TB infection and disease. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm
- ³ CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000;49(No. RR-6):38–39. Available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- ⁴ National Tuberculosis Controllers Association, National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care*. Atlanta, GA: 1997:64, 69, 74.
- ⁵ CDC. Module 9: patient adherence to tuberculosis treatment. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.

Contact Investigation

CONTENTS

Introduction.....	11.2	Contact Evaluation, Treatment, and Follow-up	11.27
Purpose.....	11.2	Immunocompromised contacts and children under five	11.29
Policy	11.3	Immunocompetent adults and children five and older (high- and medium-priority contacts).....	11.30
State Laws and Regulations.....	11.4	Contacts with prior positive tuberculin skin tests.....	11.31
Forms.....	11.4	When to Expand a Contact Investigation	11.33
Structure of a Contact Investigation	11.5	Guidelines for expanding an investigation.....	11.33
Basic steps of a contact investigation.....	11.5	Low-priority contacts	11.35
Contact investigation plan.....	11.5	Data Management and Evaluation of Contact Investigations.....	11.36
Decision to Initiate a Contact Investigation	11.6	Reasons contact investigation data are needed	11.36
Factors predicting transmission of tuberculosis.....	11.6	Approach.....	11.37
Deciding to initiate a contact investigation.....	11.9	Index patient and contact data	11.38
Time Frames for Contact Investigation	11.12	Evaluation of a contact investigation.....	11.40
Information about the index patient and transmission sites	11.12	Outbreak Investigation.....	11.42
Contact evaluation and treatment	11.14	Definition of a tuberculosis outbreak	11.42
Ongoing management activities.....	11.15	Deoxyribonucleic acid genotyping.....	11.43
Infectious Period.....	11.17	Resources and References.....	11.44
Index Patient Interviews.....	11.19		
Preinterview preparation.....	11.19		
General guidelines for interviewing an index patient.....	11.20		
Field Investigation	11.21		
Contact Priorities.....	11.23		
Index patient with positive acid-fast bacilli sputum smear results or cavitory tuberculosis	11.24		
Index patient with negative acid-fast bacilli sputum smear results.....	11.25		
Index patient with negative bacteriologic results and abnormal chest radiographs not consistent with tuberculosis	11.26		

Introduction

Purpose

A contact investigation is the process of identifying, examining, evaluating, and treating all persons who are at risk for infection with *Mycobacterium tuberculosis* due to recent exposure to a newly diagnosed or suspected case of pulmonary, laryngeal, or pleural tuberculosis (TB).

The primary goal of a contact investigation is to do the following:

- Identify persons who were exposed to an infectious case of TB.
- Ensure that contacts receive these evaluation services:
 - Testing for *M. tuberculosis* infection
 - Screening for TB disease
 - Medical evaluation, if indicated
 - Prompt initiation of treatment for latent tuberculosis infection (LTBI) if at high risk for developing TB disease (younger than five years of age or immunocompromised)
 - A complete, standard course of treatment, unless medically contraindicated¹

In addition, the following are secondary goals of a contact investigation:

- Stop transmission of *M. tuberculosis* by identifying persons with previously undetected infectious TB.
- Determine whether a TB outbreak has occurred (in which case, an expanded outbreak investigation should ensue).²

Use this section to understand and follow national, State Of Michigan and MIACET guidelines to address the following:

- Decide when to initiate a contact investigation.
- Understand the time frames for key contact investigation activities.
- Estimate the infectious period.
- Conduct index patient interviews.
- Assign priorities to contacts.
- Complete contact evaluation, treatment, and follow-up.
- Determine when to expand a contact investigation.
- Manage data and evaluate contact investigations.
- Conduct an outbreak investigation.

Except in rare cases, every case of TB begins as a contact to a person with active pulmonary, laryngeal, or pleural TB disease. For this reason, the Centers for Disease Control and Prevention (CDC) has identified contact investigations (i.e., seeking and evaluating contacts) as a fundamental strategy for the prevention and control of TB. To control and prevent TB, healthcare resources and efforts should be directed to meeting the priorities outlined in the 2005 “Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America.” One of the recommended strategies for achieving the goal of reduction of TB morbidity and mortality is prompt identification of contacts to patients with infectious TB and timely treatment of those at risk with an effective drug regimen.³ National recommendations for contact investigations are provided in the CDC’s “Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis: Recommendations from the National Tuberculosis Controllers Association and CDC, and Guidelines for Using the QuantiFERON®-TB Gold Test for Detecting *Mycobacterium tuberculosis* Infection, United States” (MMWR 2005;54[No. RR-15]:1–49).

One of the major challenges to successful control of TB is in protecting contacts of persons with infectious TB and in preventing and responding to TB outbreaks.⁴ Reducing the risk of TB among contacts through the development of better methods of identification, evaluation and management, would lead to substantial personal and public health benefits and facilitate progress toward eliminating TB in the United States.⁵

The evaluation of contacts of cases of infectious TB is one of the most productive methods of identifying adults and children with LTBI at high risk for progression to TB disease and persons in the early stages of TB disease. Contact investigations, therefore, serve as an important means of detecting TB cases and at the same time identify persons in the early stage of LTBI, when the risk for progression to TB disease is high and the benefit of treatment is greatest.⁶ A study showed that improvements in contact investigations might have prevented 17 (10%) of 165 pediatric TB cases in California in 1994.⁷

Policy

A contact investigation is recommended for the following forms of suspected or confirmed TB because they are likely to be infectious:

- Pulmonary, laryngeal, or pleuropulmonary disease with either pulmonary cavities, or respiratory specimens that have acid-fast bacilli (AFB) on microscopy, or (especially) both.⁸
- Persons with AFB sputum smear negative results are less likely to be infectious but are still capable of infecting others.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

Michigan Communicable Disease Rules (325.174) empower and obligate local health departments to perform contact investigations as necessary.

Forms



Contact investigation data should be entered into the Contact Information page of the index or source case’s RVCT form in the MDSS. In addition, yearly reporting of investigation, evaluation and treatment of contacts to culture-confirmed cases is also required. This data is reported in aggregate using the form “Aggregate Report for Tuberculosis Program Evaluation: Follow-up and Treatment for Contacts to Tuberculosis Cases”, and is sent to local health departments yearly by the MDCH TB Control Program.

Structure of a Contact Investigation

Basic Steps of a Contact Investigation

A successful contact investigation requires the careful gathering and evaluation of detailed information, often involving many people. In general, contact investigations follow a process that includes these steps:

1. Preinterview preparation
2. Index patient interviews
3. Field investigation
4. Risk assessment for *Mycobacterium tuberculosis* transmission
5. Decision about priority of contacts
6. Evaluation of contacts
7. Treatment and follow-up of contacts
8. Decision about whether to expand testing
9. Evaluation of contact investigation activities^{9,10}

Although these steps are presented in sequence above, it is important to remember that contact investigations do not always follow a predetermined sequence of events.¹¹

Contact Investigation Plan

The investigation plan starts with information gathered during interviews and site visits. It should include a registry of the contacts, their assigned priorities, and a written timeline. The timeline sets expectations for monitoring the progress of the investigation, and it informs public health officials whether additional resources are needed for finding, evaluating, and treating the high- and medium-priority contacts.



For more information on timelines, see Table 2: **Time Frames for Investigating the Index Patient and the Sites of Transmission** and Table 3: **Time Frames for Contact Evaluation and Treatment** in this section's topic "Time Frames for Contact Investigation."

The plan is a work in progress and should be revised if additional information indicates a need to expand a contact investigation. It is part of the permanent record of the overall investigation for later review and program evaluation.¹²

Decision to Initiate a Contact Investigation

Factors Predicting Transmission of Tuberculosis

Decide when to initiate a contact investigation using the criteria provided in this topic. Competing demands restrict the resources that can be allocated to contact investigations. Therefore, public health officials must decide which contact investigations are more significant and which contacts to evaluate first.

The index patient is the first patient that comes to the investigator's attention as an indicator of a potential public health problem. Whether or not to investigate an index patient depends upon factors predicting transmission. See Table 1: **Index Patient Factors Increasing Transmission Risk**. In addition, other information about the index patient, such as social habits or workplace environments, can influence the investigative strategy.¹³



Record your decision and rationale for initiating a contact investigation in the index or source case's chart.

Table 1. INDEX PATIENT FACTORS INCREASING TRANSMISSION RISK¹⁴

Characteristics of the Index Patient	Behaviors of the Index Patient
<ul style="list-style-type: none">▪ Pulmonary, laryngeal, or pleuropulmonary tuberculosis (TB)▪ Positive acid-fast bacilli sputum smear results▪ Cavitation on chest radiograph▪ Adolescent or adult patient▪ Lack of treatment or ineffective treatment of TB disease	<ul style="list-style-type: none">▪ Frequent coughing▪ Sneezing▪ Singing▪ Close social network

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and Guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.

Anatomical Site of Disease

Ordinarily, patients with pulmonary or laryngeal tuberculosis (TB) are the only ones who can transmit their infection. For contact investigations, pleural disease is grouped with pulmonary disease because sputum cultures can yield *Mycobacterium tuberculosis* even when no lung abnormalities show on radiography. Rarely, extrapulmonary TB causes transmission during medical procedures, such as autopsy and embalming, that release aerosols.

Sputum Bacteriology

The relative infectiousness increases when sputum acid-fast bacilli (AFB) smear results are also positive.¹⁵ The significance of results from respiratory specimens other than expectorated sputum, such as bronchial washings or bronchoalveolar lavage fluid, is undetermined. Expert opinion recommends that these specimens be regarded as equivalent to sputum.

Radiographic Findings

Patients who have lung cavities observed on a chest radiograph are more infectious than patients with noncavitary disease. This is an independent predictor after bacteriologic findings are taken into account. The significance of small lung cavities that are detectable with computerized tomography (CT), but not with plain radiography, are undetermined.

Isolated instances of highly contagious endobroncheal TB in severely immunocompromised patients who temporarily had normal chest radiographs have contributed to outbreaks. The number and relative significance of such instances is unknown, but in one case series with human immunodeficiency virus (HIV)-infected TB patients, 3% who had positive AFB sputum smears had normal chest radiographs at the time of diagnosis.

Social Characteristics

Social issues can influence transmission. To assess the risk of transmission, it is important to consider the index patient's social factors, such as a close social network, residential setting or homelessness, employment, work setting, non-work-related activities, recent arrival from a foreign country, substance abuse, and intravenous drug use.

Age

Transmission from children younger than ten years of age is unusual, although it has been reported in association with those pulmonary forms of disease typically seen in adults. Contact investigations to evaluate transmission from pediatric cases should not be undertaken, except for those unusual cases. However, children younger than five years with TB, regardless of the site of disease, should have a contact investigation to identify the source case. A source-case investigation seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease. TB disease in children younger than five years typically indicates that the infection is recent. Young children usually do not transmit TB to others, and their contacts are unlikely to be infected because of exposure to them.

Human Immunodeficiency Virus Status

Evaluation of HIV status needs to be done promptly since progression to active TB may occur within weeks of exposure among individuals with acquired immunodeficiency syndrome (AIDS). HIV-infected TB patients with low CD4 T-cell counts frequently have chest radiographic findings that are not typical of pulmonary TB.¹⁶ In particular, they are more likely to have mediastinal adenopathy and less likely to have upper-lobe infiltrates and cavities. The atypical radiographic findings can lead to delayed diagnosis and prolonged infectious period of the case. However, HIV-infected patients who have pulmonary or laryngeal TB on average are only as contagious as similar patients who are not HIV infected. Contacts to HIV-infected index TB cases are also more likely to be HIV infected. Therefore, for all persons who were exposed to HIV-infected TB cases (or those with risk factors for HIV) and whose infection status is unknown, HIV counseling and testing is recommended.¹⁷ Regardless of known HIV status, HIV counseling should always be recommended for all patients as a part of the screening process.¹⁸

After Starting Chemotherapy

TB patients rapidly become less contagious while under treatment. This has been corroborated by measuring the number of viable *M. tuberculosis* organisms in sputa and by observing infection rates in household contacts. However, the exact rate of decrease cannot be predicted for individual patients, and an arbitrary determination is required for each.

Treatment After Exposure to Drug-Resistant Tuberculosis



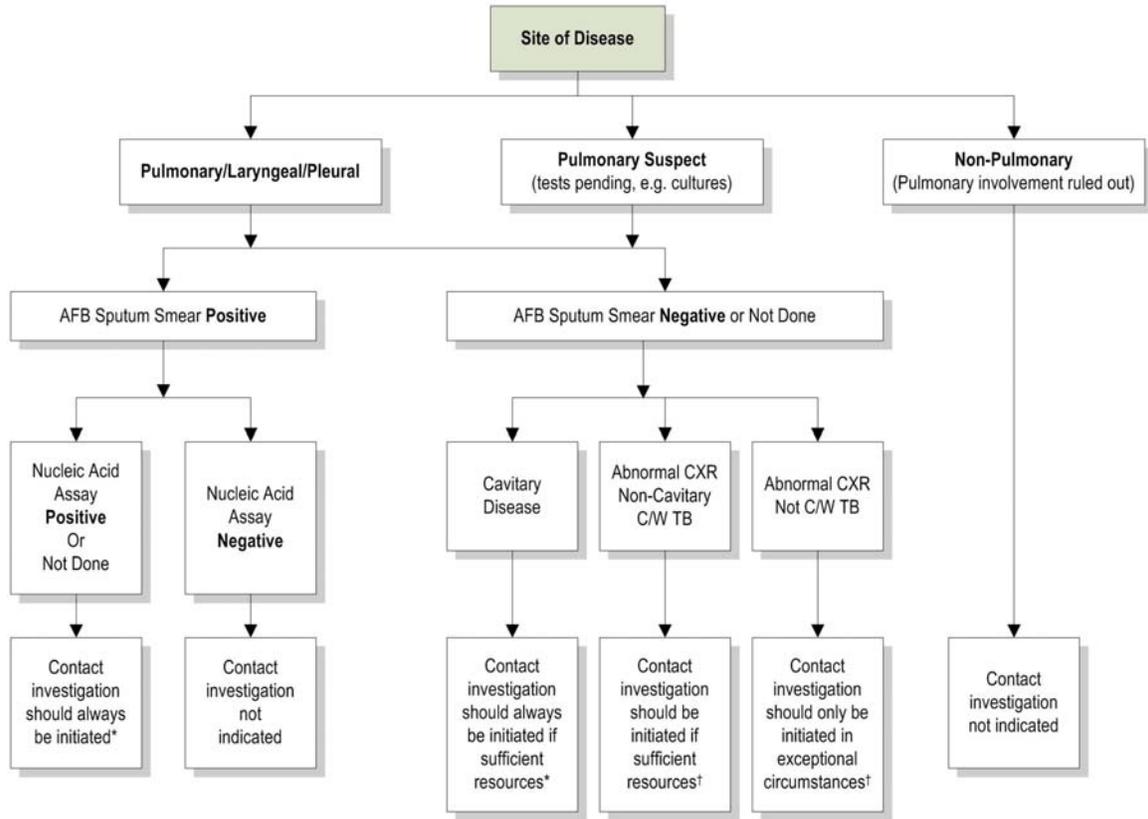
Drug susceptibility results for the *M. tuberculosis* isolate from the index patient (i.e., the presumed source of infection) are absolutely necessary for selecting the treatment regimen.

Resistance to only isoniazid (INH) leaves the option of four months of daily rifampin (RIF), but resistance to both INH and RIF constitutes multidrug-resistant TB (MDR-TB). If this is the case, all the potential regimens are poorly tolerated to some extent, while none of these regimens have been tested fully for efficacy. Therefore, a consultation with a physician having expertise in this area is strongly recommended for selecting a regimen and managing the care of contacts. Monitor contacts that are suspected to be infected with multidrug-resistant *M. tuberculosis* for two years after exposure. Contact the local health department and the MDCH TB Control Program at 517-335-8165, for consultation regarding contacts to a known or suspected drug-resistant index or source-case.

Deciding to Initiate a Contact Investigation

Consider a contact investigation for any patient with confirmed or suspected pulmonary, laryngeal, or pleuropulmonary TB. Refer to Figure 1 to help determine whether to start a contact investigation.

Figure 1: DECISION TO INITIATE A CONTACT INVESTIGATION¹⁹



Definitions of abbreviations: AFB = acid-fast bacilli; C/W = consistent with; CXR = chest radiograph; TB = tuberculosis.

* Use time frames from the middle column of Table 2 in the “Time Frames for Contact Investigation” topic.

† Use time frames from the right-hand column of Table 2 in the “Time Frames for Contact Investigation” topic.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):5.

In general, a contact investigation should be promptly initiated for an AFB sputum smear-positive pulmonary TB suspect. However, many AFB sputum smear-positive suspects may turn out to have nontuberculous mycobacteria (NTM) instead of *M. tuberculosis*. Approved nucleic acid amplification (NAA) tests for *M. tuberculosis* can be used to avoid unnecessary contact investigations for suspects with NTM, particularly in patients who are at low risk for TB.

If AFB are not detected by microscopy of three sputum smears, an investigation is still recommended if the chest radiograph shows cavities in the lung. Small parenchymal cavities that can be detected only by computerized imaging techniques (e.g., computed tomography [CT], computerized axial tomography [CAT] scan, or magnetic resonance imaging [MRI] of the chest) are not included in these guidelines.

When sputum samples have not been collected, either because of an oversight or the patient's inability to expectorate, results from other types of respiratory specimens (e.g., gastric aspirates or bronchoalveolar lavage) may be interpreted in the same way as in the above recommendations. However, whenever feasible, sputum samples for each case should be collected before or while initiating chemotherapy.

A contact investigation may still be considered for high-risk contacts of suspects with non-cavitary disease and negative AFB sputum smears. The decision depends on the amount of resources that can be allocated and on whether goals are being met for higher priority contact investigations.

Contact investigations generally should not be initiated around index patients who have suspected TB disease and minimal diagnostic findings in support of pulmonary TB. Possible exceptions can be found during outbreak investigations, especially when vulnerable or susceptible contacts are found, or during a source-case investigation. Outbreak investigations and source-case investigations are explained briefly below.

- **Outbreak Investigation:** Definitions for TB outbreaks are relative to the local context. Outbreak cases can be distinguished from other cases only when some association in time, location, patient characteristics, or *M. tuberculosis* attributes (e.g., drug resistance or genotype) becomes apparent. In low-incidence jurisdictions, any temporal cluster will cause suspicion regarding an outbreak. In places where cases are more common, clusters can be obscured by the baseline incidence rate until suspicion is triggered by a noticeable increase, a sentinel event (e.g., pediatric cases), or related *M. tuberculosis* isolates.



For more information on outbreak investigations, see the “Outbreak Investigation” topic in this section.

- **Source-Case Investigation:** A source-case investigation seeks the source of recent *M. tuberculosis* infection, perhaps newly diagnosed TB disease. A source case or patient is the original source of infection for secondary cases or contacts. The source case can be, but is not necessarily, the index patient.



For more information on source-case investigations, see the CDC's "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis Cases" (*MMWR* 2005;54[No. RR-15]: 31) at this hyperlink: <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf> .

Time Frames for Contact Investigation

Use this topic to understand the time frames for key contact investigation activities. A suspected or confirmed case of tuberculosis (TB) becomes designated as an “index patient” when that person is the first patient to appear as an indicator of a potential public health problem. An investigation is launched because of an index patient, and the investigation often starts with an interview of the index patient.

Information about the Index Patient and Transmission Sites

Comprehensive information about an index patient is the foundation of a contact investigation. This information includes the disease characteristics, the onset date of the illness, names of contacts, exposure locations, and current medical factors, such as initiation of effective treatment and drug susceptibility results.

The infectiousness of the index patient determines the recommended time frames for pursuing the investigation. Indications of infectiousness include symptoms (such as cough, fever, weight loss, and night sweats), a positive acid-fast bacilli (AFB) sputum smear, a positive nucleic acid amplification (NAA) test, cavitory disease, or an abnormal chest radiograph consistent with TB.

Refer to Table 2: **Time Frames for Investigating the Index Patient and the Sites of Transmission** for the recommended time frames for index patient interviews and visits to the residence transmission sites.



Some readers confuse prioritizing an investigation with prioritizing follow-up of individual contacts within an investigation. The following explains the difference between the two:

- The time priority for investigating the index patient and transmission sites is determined by the infectiousness of the index patient. Indications of infectiousness include positive AFB sputum smear results as well as symptoms, positive NAA test results, and chest radiographs showing cavitory disease or abnormalities consistent with TB.
- Priority-ranking contacts for follow-up within an investigation is based on the characteristics of the index patient, the duration and circumstances of the exposure, and the vulnerability/susceptibility of the contacts to progression from TB infection to the development of TB disease.



For information on how to determine which contacts are high, medium, and low priority, see the “Contact Priorities” topic in this section.

Table 2: TIME FRAMES FOR INVESTIGATING THE INDEX PATIENT AND THE SITES OF TRANSMISSION²⁰

Activity	Suspects Expected to Be Cases of Tuberculosis	
	Suspects with Indications of Infectiousness	Suspects without Indications of Infectiousness
<p>First Index Patient Interview Number of days following notification within which the index patient should be interviewed in person (i.e., not by telephone)</p>	≤1 Business Day of Reporting	≤3 Business Days of Reporting
<p>Residence Visit Number of days following the first index patient interview within which the place of residence of the index patient should be visited</p>	≤3 Business Days After the First Interview	3 Business Days After the First Interview
<p>Field Investigation Number of days following initiation of the contact investigation within which all potential settings for transmission should be visited</p>	5 Business Days After the Start of the Investigation	5 Business Days After the Start of the Investigation
<p>Index Patient Reinterviews Length of time after the first interview within which the index patient should be reinterviewed one or more times for clarification and additional information</p>	1 or 2 Weeks After the First Interview	1 or 2 Weeks After the First Interview
<p>Reassessment of the Index Patient Information about the index patient should be reassessed at least weekly until drug-susceptibility results are available for the <i>Mycobacterium tuberculosis</i> isolate or for 2 months following notification, whichever is longer.</p>		

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7–8.

Contact Evaluation and Treatment

In addition to the investigation of the index patient and transmission sites, a contact investigation also involves contact follow-up. Refer to Table 3: **Time Frames for Contact Evaluation and Treatment** to monitor the progress of the investigation and determine whether additional resources are needed for finding, evaluating, and treating the high- and medium-priority contacts.



Priority-ranking contacts for investigation is based on the likelihood of infection and the potential hazard to the individual contact if infected.²¹ For information on how to determine which contacts are high-, medium-, or low-priority, see the “Contact Priorities” topic in this section.

Table 3: TIME FRAMES FOR CONTACT EVALUATION AND TREATMENT²²

Type of Contact	Business Days from Listing of a Contact to Initial Encounter*	Business Days from Initial Encounter to Completion of Medical Evaluation†	Business Days from Completion of Medical Evaluation to Start of Treatment
High-Priority Contact Index patient with positive acid-fast bacilli (AFB) sputum smear results or cavitory disease on chest radiograph	3 Business Days After Being Listed in the Investigation²³	5 Business Days	10 Business Days
		5 Business Days  Children and high-risk contacts can develop complicated tuberculosis (TB) within a few weeks of infection.	
High-Priority Contact Index patient with negative AFB sputum smear results	3 Business Days After Being Listed in the Investigation²⁴	10 Business Days	10 Business Days
Medium-Priority Contact Regardless of AFB sputum smear or culture result	3 Business Days After Being Listed in the Investigation²⁵	10 Business Days	10 Business Days

* “Encounter” means a face-to-face meeting, which gives the public health worker a chance to determine whether the contact is generally healthy or ill. The initial encounter also provides opportunities to administer a tuberculin skin test (TST) and to schedule further evaluation.

† The medical evaluation is complete when the contact’s status relative to *Mycobacterium tuberculosis* infection or TB disease has been determined. A normal exception to this schedule is the delay in waiting for final mycobacteriologic results, but this applies to relatively few contacts.

Source: Adapted from CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):9.

Ongoing Management Activities

Ongoing contact follow-up includes testing, medical evaluation, and treatment. Information from contact follow-up guides decisions about whether to expand a contact investigation. Refer to Table 4: **Overview of Ongoing Management Activities and Maximum Time Frames** to monitor the progress of ongoing contact follow-up and to determine when to decide whether to expand the investigation.

Table 4: OVERVIEW OF ONGOING MANAGEMENT ACTIVITIES AND MAXIMUM TIME FRAMES²⁶

Activity	Purpose	Maximum Time Interval
Review all documentation	To ensure that contact list is complete	Ongoing
Review and assess completeness of each contact's medical follow-up and treatment plan	To ensure appropriate and complete medical follow-up	5 business days after each contact's medical evaluation is completed*
Review and assess the timeliness of initiating the treatment plan	To avoid delays in treatment initiation, particularly in high-risk contacts	10 business days after each contact's medical evaluation is completed*
Determine if transmission occurred	To decide whether to expand investigation	At completion of follow-up testing, or if secondary cases are identified
Obtain and review drug-susceptibility results	To determine if contacts are receiving appropriate treatment for latent tuberculosis infection (LTBI)	1 to 2 months after the index patient's initial sputum collection date
Repeat tuberculin skin test (TST) if contact is initially TST-negative	To determine if contact has converted (TB Class I to TB Class II)	8 to 10 weeks after each contact's initial TST or last exposure to the index patient†
Reevaluate contacts who were initially TST-negative and started on LTBI treatment (Window Period Treatment for a TB Class I Contact)	To determine if treatment for LTBI should be continued	8 to 10 weeks after each contact's initial TST or last exposure to the index patient before the end of the infectious period†

Activity	Purpose	Maximum Time Interval
Assess contacts' adherence with medical follow-up and TB medication	To remove barriers and ensure timely and complete evaluation and follow-up	Monthly, at the time of each visit
Ensure contacts are monitored for adverse reactions and toxicity of LTBI treatment regimens	To prevent development of adverse effects and toxicity from drug regimens	At least monthly while on LTBI treatment
Evaluate problems and concerns that arise and may delay or hamper the contact investigation	To remove barriers and ensure timely and complete evaluation and follow-up	Whenever problems are identified
Collect and analyze data to evaluate the contact investigation	To provide epidemiologic analysis of investigations and to measure performance using indicators that reflect performance objectives ²⁷	Ongoing
Collect data to complete the <i>Aggregate Reports for Tuberculosis Program Evaluation (ARPE)</i> form ²⁸	To report on investigation to the Centers for Disease Control and Prevention	Ongoing
<p>* The medical evaluation is complete when the contact's status relative to <i>Mycobacterium tuberculosis</i> infection or TB disease has been determined. A normal exception to this schedule is the delay in waiting for final mycobacteriologic results, but this applies to relatively few contacts.</p> <p>† Third TST: In rare circumstances, an infectious index patient with advanced disease can stay infectious for several months. In these circumstances, the second TST for negative contacts should be performed in the usual time frame (8 to 10 weeks). This will identify any contacts who have already converted so they can be evaluated for treatment. However, any household members who remain TST negative and have continued exposure to the infectious index patient should have a third TST 8 to 10 weeks after the index patient becomes noninfectious. This is especially true for contacts who are infants in a household where a resident is culture positive after 3 months or has multidrug-resistant TB. For example, a household member with continued exposure to an infectious index patient had a negative second TST on 3/12/2007. The last date the index patient was infectious was 3/5/2007. The household member should have a third TST 8 to 10 weeks from 3/5/2007. For consultation regarding the appropriateness of a third TST, contact the local health department or call the MDCH TB Control Program at 517-335-8165.</p>		

Source: Adapted from: California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Contact investigation guidelines. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. November 12, 1998:18. Available at: <http://www.ctca.org/guidelines/IID1contactinvestigation.pdf> . Accessed July 6, 2006.

Infectious Period

Determine the infectious period to focus the investigation on those contacts most likely to be at risk for infection and to set the time frame for testing contacts.

The infectious period is the time frame in which potential exposure to others may have occurred while the patient was infectious or able to transmit tuberculosis (TB).²⁹ It is impossible to determine the exact start of the infectious period, so a practical estimation is necessary. From expert opinion, the infectious period is generally assumed to be three months prior to TB diagnosis or the definite onset of symptoms (especially if the patient was symptomatic prior to diagnosis), but some circumstances may indicate an earlier start.

Assemble information from the index patient interview and other sources to estimate the infectious period. Helpful details include the approximate dates that TB symptoms were noticed, bacteriologic results, and the extent of disease. For example, lung cavities imply prolonged illness as well as infectiousness.

Table 5: GUIDE FOR ESTIMATING THE BEGINNING OF THE PERIOD OF INFECTIOUSNESS³⁰

Index Patient Characteristics						Recommended Beginning of Likely Period of Infectiousness
Tuberculosis Symptoms		Positive Acid-Fast Bacilli Sputum Smear Results		Cavitary Chest Radiograph		
Yes	No	Yes	No	Yes	No	
✓			✓		✓	3 months prior to symptom onset or first positive finding consistent with tuberculosis (TB) disease (whichever is longer)
✓		✓		✓		3 months prior to symptom onset or first positive finding consistent with TB disease (whichever is longer)
	✓		✓		✓	4 weeks prior to date of suspected diagnosis
	✓	✓		✓		3 months prior to first positive finding consistent with TB

Source: California Department of Health Services Tuberculosis Control Branch; California Tuberculosis Controllers Association. Contact investigation guidelines. Berkeley, CA: California Department of Health Services; 1998; in CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7.

For the purposes of contact investigation, the end of potential exposure to the infectious case determines the end of the infectious period. The potential for transmission is reduced by the initiation and duration of treatment, the index patient's response to treatment, and/or the application of effective infection control measures. In general, **for the purposes of contact investigation**, the infectious period is closed when exposure to contacts has ended **OR** when **all** of the following criteria are met:

1. The index patient is receiving effective treatment (as demonstrated by *Mycobacterium tuberculosis* susceptibility results) for at least two weeks.
2. The index patient has diminished symptoms.
3. The index patient exhibits mycobacteriologic response (e.g., decrease in grade of sputum smear positivity detected on sputum-smear microscopy).^{31,32}

Take careful note of the following exceptions:

- **Multidrug-resistant TB (MDR-TB):** MDR-TB can extend infectiousness if the treatment regimen is ineffective.
- **Signs of infectiousness:** Any index patient with signs of extended infectiousness should be continually reassessed for recent contacts.
- **Susceptible contacts:** Apply more stringent criteria for setting the end of the infectious period if particularly susceptible contacts are involved. A patient returning to a congregate living setting or to any setting in which susceptible persons might be exposed should have at least three consecutive negative AFB sputum smear results from sputum collected more than eight hours apart (with one specimen collected during the early morning) before being considered noninfectious.³³

Index Patient Interviews

Conduct index patient interviews to set the direction for the contact investigation, identify contacts, provide opportunities for the patient to learn about tuberculosis (TB) and its control, and help the public health worker learn how to provide treatment and care specific to that patient.

During index patient interviews, gather information about the index patient's medical history, treatment needs, residence, transmission sites, dates and times at specific transmission sites, and contacts at specific sites. Use the information from these interviews to decide whether to start a contact investigation, establish its priority relative to other investigations, and determine the scope of the investigation.

There should be an initial interview and one or two reinterviews before discharge from the hospital, or within one to two weeks if the initial interview occurs in the home, to obtain further information and answer additional questions.³⁴



TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker (New Jersey Medical School Global Tuberculosis Institute Web site; 2004) at this hyperlink:

<http://www.umdnj.edu/globaltb/products/tbinterviewing.htm> offers specific suggestions on how to prepare for and conduct the interviews.³⁵



Record information regarding the index patient and contacts in the patient's chart.

Preinterview Preparation

Gather information on the patient and the circumstances of the illness to prepare for the first interview.

Consult these sources:

- Current medical record
- Physician
- Laboratory, clinic, or other reporting source
- Infection prevention staff (if the patient is hospitalized)

The Privacy Rule in the Health Insurance Portability and Accountability Act (HIPAA) permits disclosure of medical record information to public health authorities.³⁶

General Guidelines for Interviewing an Index Patient

1. Discuss confidentiality and privacy in frank terms to help the patient decide how to share information, and revisit these topics several times during the interview to stress their importance. Emphasize confidentiality, but inform the patient that relevant information may need to be shared with other health department staff or other persons who may assist in congregate settings to most efficiently determine which contacts need to be evaluated. Inform the patient that it will be necessary for visits to be made at sites such as the home, workplace/school, or leisure establishments to assess the shared air environment to accurately structure the contact investigation.³⁷
2. Conduct the interviews in the patient's language, using a medical interpreter if the patient does not speak English.
3. Conduct the interviews in a culturally competent manner.



For more information on cultural sensitivity, refer to the *Participant's Workbook* for Session 4: "Working with Culturally Diverse Populations" in the *Directly Observed Therapy Training Curriculum for TB Control Programs* (Francis J. Curry National Tuberculosis Center Web site; 2003) at this hyperlink:

<http://www.nationaltbcenter.ucsf.edu/catalogue/epub/index.cfm?uniqueID=2&tableName=DOTE> .



For assistance with language issues, see the *Language Services Resource Guide for Health Care Providers* (The National Health Law Program Web site; 2006) at this hyperlink:

<http://www.healthlaw.org/library.cfm?fa=download&resourceID=89928&appView=folder&print> . Please note this download is very slow.

Field Investigation

A field investigation includes visiting the patient's home (or shelter), workplace, or school (if any), and the other places where the patient said he or she spent time while infectious. The field investigation is important and should be done even if the patient interview has already been conducted. The purpose of the field investigation is to identify contacts and evaluate the environmental characteristics of the places in which exposure occurred. The field investigation may provide additional information for use in the risk assessment and for identifying additional contacts.³⁸

During field visits, the healthcare worker should do the following:

- **Observe environmental characteristics**, such as room size, crowding, and ventilation, to estimate the risk of tuberculosis (TB) transmission: air volume, exhaust rate, and circulation predict the likelihood of transmission in an enclosed space. In large indoor settings, the degree of proximity between contacts and the index patient can influence the likelihood of transmission. The most practical system for grading exposure settings is to categorize them by size (e.g., “1” being the size of a vehicle or car, “2” the size of a bedroom, “3” the size of a house, and “4” a size larger than a house). A large volume of air shared between an infectious TB patient and contacts may dilute infectious particles. Local circulation and overall room ventilation also dilute infectious particles, but both factors have to be considered because they can redirect exposure into spaces that were not visited by the index patient.³⁹
- **Identify additional contacts** (especially children) and their locating information, such as phone numbers and addresses.
- **Look for evidence of other contacts** who may not be present at the time of the visit (for example, pictures of others who may live in or visit the house, shoes of others who may live in the house or toys left by children).
- **Interview and skin test high- and medium-priority contacts** who are present and arrange for reading of the tuberculin skin test (TST) results.
- **Educate the contacts** about the purpose of a contact investigation, the basics of transmission, the risk of transmitting *Mycobacterium tuberculosis* to others, and the importance of testing, treatment, and follow-up for TB infection and disease.
- **Refer contacts who have TB symptoms** to the health department for a medical evaluation, including radiography and sputum collection.⁴⁰



Collect all information obtained during field investigations in the patient's chart. A sample form to collect field investigation data is available through the New Jersey Medical School Global Tuberculosis Institute at: <http://www.umdnj.edu/globaltb/performanceimprovement.htm>.

Healthcare workers should remember to follow infection control precautions while visiting a potentially infectious TB patient at home or in any other location. These precautions may include wearing a personal respirator.⁴¹



For more information on infection control, see the Infection Control section.

Another critical consideration during field investigations is safety. Healthcare workers should become familiar with policies and recommendations of local law enforcement agencies and health department administration regarding personal safety. Current information on local high-risk areas for crime can be very valuable in planning and conducting safe field visits.

General safety precautions that are recommended for the healthcare worker include the following:

- Wearing an identity badge with a current photo
- Working in pairs when visiting a potentially dangerous area
- Informing someone of your itinerary and expected time of return, especially if you anticipate problems⁴²

Contact Priorities

Assign priorities to contacts, using the registry of contacts compiled from the index patient interviews, site visits, interviews with contacts, and information from other persons involved in the investigation. The Centers for Disease Control and Prevention (CDC) defines the three levels of contact priorities as follows:

- High-priority contacts
- Medium-priority contacts
- Low-priority contacts

Contact priorities are determined by the likelihood of infection and the potential hazards to the individual contact if infected.⁴³ Priority-ranking contacts for investigation is based upon the characteristics of the index patient, the duration and circumstances of the exposure, and the vulnerability/susceptibility of the contacts to disease from *Mycobacterium tuberculosis* infection.⁴⁴

Refer to the tables below to prioritize contacts of index patients with pulmonary, AFB smear-positive or cavitary disease; or of index patients with pulmonary, AFB smear-negative disease. Use the assigned priorities to allocate resources to complete all investigative steps for the high- and medium-priority contacts.⁴⁵ Dividing contacts into these three levels provides a system for public health staff to reach high-priority contacts first, followed by medium-priority and low-priority contacts. The priority scheme directs resources to the following essential actions:

1. Find contacts who are secondary active tuberculosis (TB) cases.
2. Find contacts who have recent *M. tuberculosis* infection—the most likely to benefit from treatment.
3. Select contacts who are most likely to progress to TB disease if they are infected (i.e., susceptible contacts) or who could suffer severe morbidity if they had TB disease (i.e., vulnerable contacts).⁴⁶



Timely initiation of treatment is especially important for susceptible and vulnerable contacts. Refer to Table 3: **Time Frames for Contact Evaluation and Treatment** in the “Time Frames for Contact Investigation” topic.

Index Patient with Positive Acid-Fast Bacilli Sputum Smear Results or Cavitory Tuberculosis

Table 6: PRIORITIZATION OF CONTACTS TO SMEAR-POSITIVE OR CAVITARY CASES⁴⁷

High-Priority Contacts	Medium-Priority Contacts	Low-Priority Contacts
<ul style="list-style-type: none"> ▪ Household contacts ▪ Contacts <5 years old ▪ Contacts with human immunodeficiency virus (HIV) infection or other immunocompromising condition ▪ Contacts with exposure during a medical procedure such as bronchoscopy, sputum induction, or autopsy ▪ Contacts with exposure in a congregate setting ▪ Contacts whose exposure exceeds specific duration/environment limits per unit time established by the local health department for high-priority contacts 	<ul style="list-style-type: none"> ▪ Contacts not in high-priority groups ▪ Contacts 5–15 years old ▪ Contacts whose exposure exceeds specific duration/environment limits per unit time established by the local health department for medium-priority contacts 	<ul style="list-style-type: none"> ▪ Contacts not in high-priority groups ▪ Contacts not in medium-priority groups

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54 (No. RR-15):12.

Index Patient with Negative Acid-Fast Bacilli Sputum Smear Results

Table 7: PRIORITIZATION OF CONTACTS TO SMEAR-NEGATIVE CASES⁴⁸

High-Priority Contacts	Medium-Priority Contacts	Low-Priority Contacts
<ul style="list-style-type: none"> ▪ Contacts <5 years old ▪ Contacts with human immunodeficiency virus (HIV) infection or other immunocompromising conditions ▪ Contacts exposed during a medical procedure such as bronchoscopy, sputum induction, or autopsy 	<ul style="list-style-type: none"> ▪ Contacts not in high-priority groups ▪ Household contacts ▪ Contacts exposed in a congregate setting ▪ Contacts whose exposure exceeds specific duration/environment limits per unit time established by the local health department for medium-priority contacts 	<ul style="list-style-type: none"> ▪ Contacts not in high-priority groups ▪ Contacts not in medium-priority groups

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):13.

Index Patient with Negative Bacteriologic Results and Abnormal Chest Radiographs not Consistent with Tuberculosis

Use Table 8 to prioritize contacts to a suspected case of pulmonary TB who is acid-fast bacilli (AFB) sputum smear negative, who is nucleic acid amplification (NAA) negative and culture negative, and who has abnormal chest radiographs not consistent with TB disease. Note: contacts to such cases would only be evaluated under extraordinary circumstances or upon strong clinical suspicion that transmission of TB occurred.

Table 8: PRIORITIZATION OF CONTACTS TO CASES WITH NEGATIVE BACTERIOLOGIC RESULTS AND ABNORMAL CHEST RADIOGRAPHS NOT CONSISTENT WITH TUBERCULOSIS⁴⁹

High-Priority Contacts	Medium-Priority Contacts	Low-Priority Contacts
	<ul style="list-style-type: none"> ▪ Household contacts ▪ Contacts <5 years old ▪ Contacts with human immunodeficiency virus (HIV) infection or other medical risk factor ▪ Contacts exposed during a medical procedure such as bronchoscopy, sputum induction, or autopsy 	<ul style="list-style-type: none"> ▪ Contacts not in medium-priority groups

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15):14.

Contact Evaluation, Treatment, and Follow-up

Complete evaluation, treatment and follow-up for high- and medium-priority contacts as specified in your contact investigation plan. The Centers for Disease Control and Prevention (CDC) recommends the following:

- 
- Provide each high- and medium-priority contact an initial assessment that includes a face-to-face encounter in which an impression of each contact's general health is formed and a tuberculin skin test (TST) is usually administered.
 - Medically evaluate each high- and medium-priority contact to determine whether tuberculosis (TB) disease or latent tuberculosis infection (LTBI) is present or absent.
 - Timely initiation of treatment is especially important for high-priority contacts and for contacts likely to progress to TB disease if they are infected (i.e., susceptible contacts) or contacts who could suffer severe morbidity if they had TB disease (i.e., vulnerable contacts). For recommended time frames, refer to Table 3: **Time Frames for Contact Evaluation and Treatment** in the "Time Frames for Contact Investigation" topic.
 - Use the same diagnostic methods for all contacts, except when they have medical or constitutional conditions making TB more likely or more difficult to diagnose. A contact's country of origin and bacille Calmette-Guérin (BCG) vaccination are not included in algorithms for diagnosis or treatment. Interpret a positive TST in a foreign-born or BCG-vaccinated person as evidence of recent *Mycobacterium tuberculosis* infection in contacts of persons with infectious cases. Evaluate these contacts for TB disease and offer them a course of treatment for LTBI.⁵⁰

Refer to the algorithms in figures 4, 5 and 6 to guide the evaluation activities for contacts in these different risk groups and priority rankings:

- **Figure 4:** Evaluation, Treatment, and Follow-Up of **Immunocompromised Contacts and Children Under Five Years Old**
- **Figure 5:** Evaluation, Treatment, and Follow-Up of **Immunocompetent Adults and Children Five and Older (High- and Medium-Priority Contacts)**
- **Figure 6:** Evaluation, Treatment, and Follow-Up of **Contacts with Prior Positive Tuberculin Skin Tests**



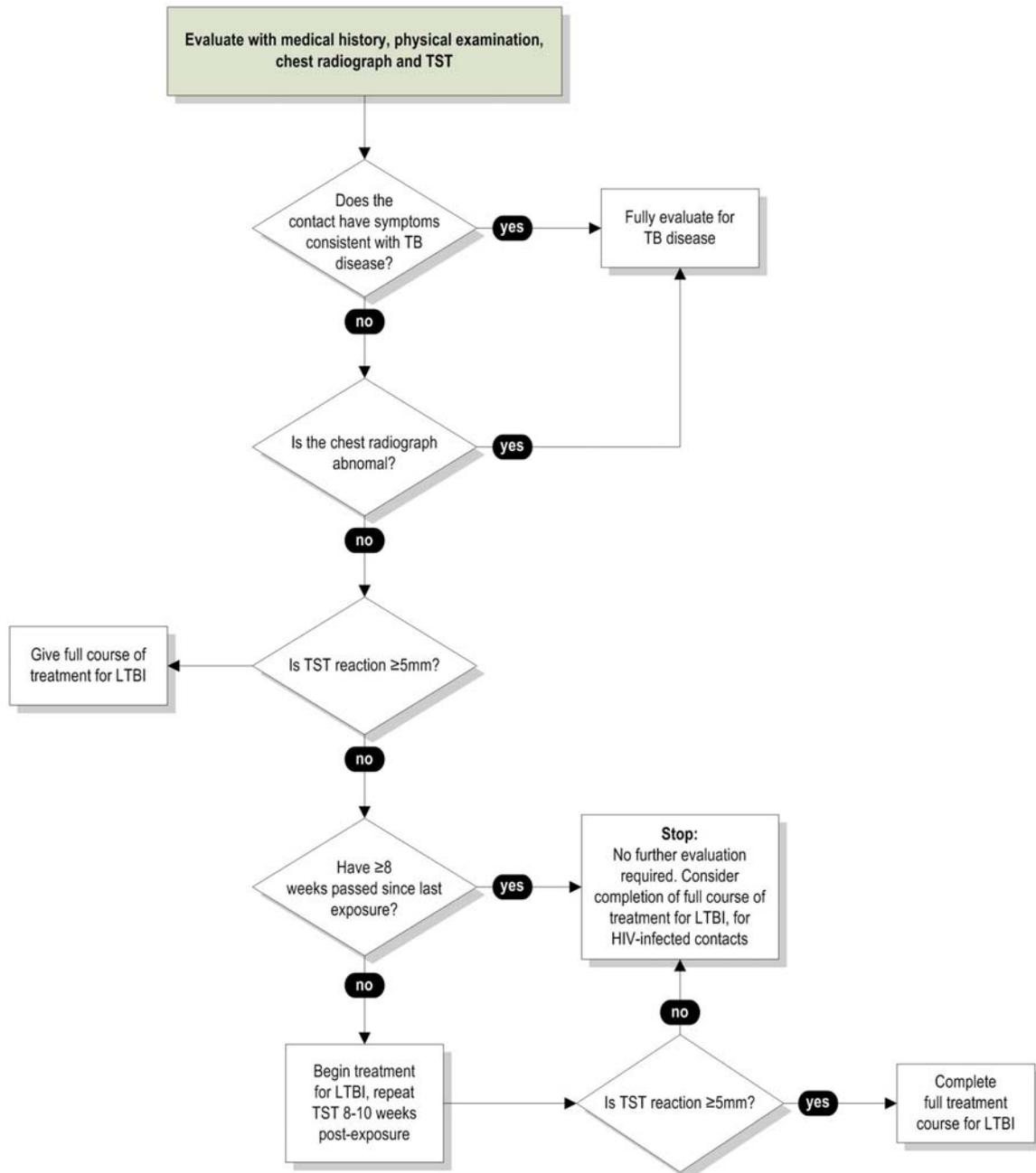
During contact evaluation, treatment, and follow-up, record information in the contact's chart or the patient's chart if your health department does not file contact evaluation information separately. Contact evaluation data should also be entered into the Contact Information page of the index or source case's RVCT form in the MDSS.



For time frames, see the “Time Frames for Contact Investigation” topic in this section. To arrange follow-up with public health officials in other jurisdictions for out-of-area contacts, see the Transfer Notifications section.⁵¹

Immunocompromised Contacts and Children under Five

Figure 4: EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPROMISED CONTACTS AND CHILDREN UNDER FIVE YEARS OLD⁵²



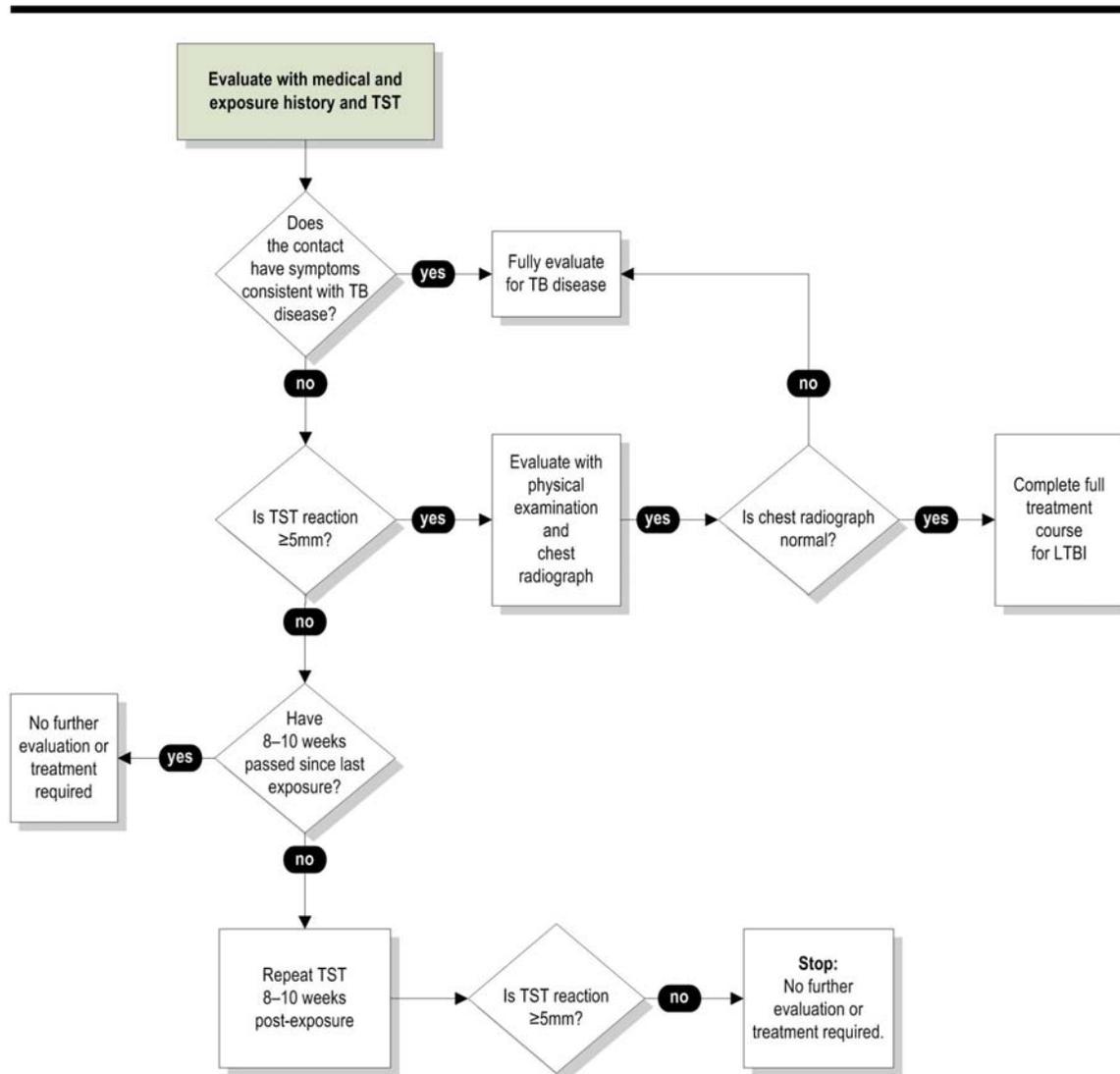
Definition of abbreviations: HIV = human immunodeficiency virus; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TST = tuberculin skin test.

Note: An IGRA may be used in place of a TST.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):15.

Immunocompetent Adults And Children Five And Older (High- And Medium-Priority Contacts)

Figure 5: EVALUATION, TREATMENT, AND FOLLOW-UP OF IMMUNOCOMPETENT ADULTS AND CHILDREN FIVE YEARS OR OLDER (HIGH- AND MEDIUM-PRIORITY CONTACTS)⁵³



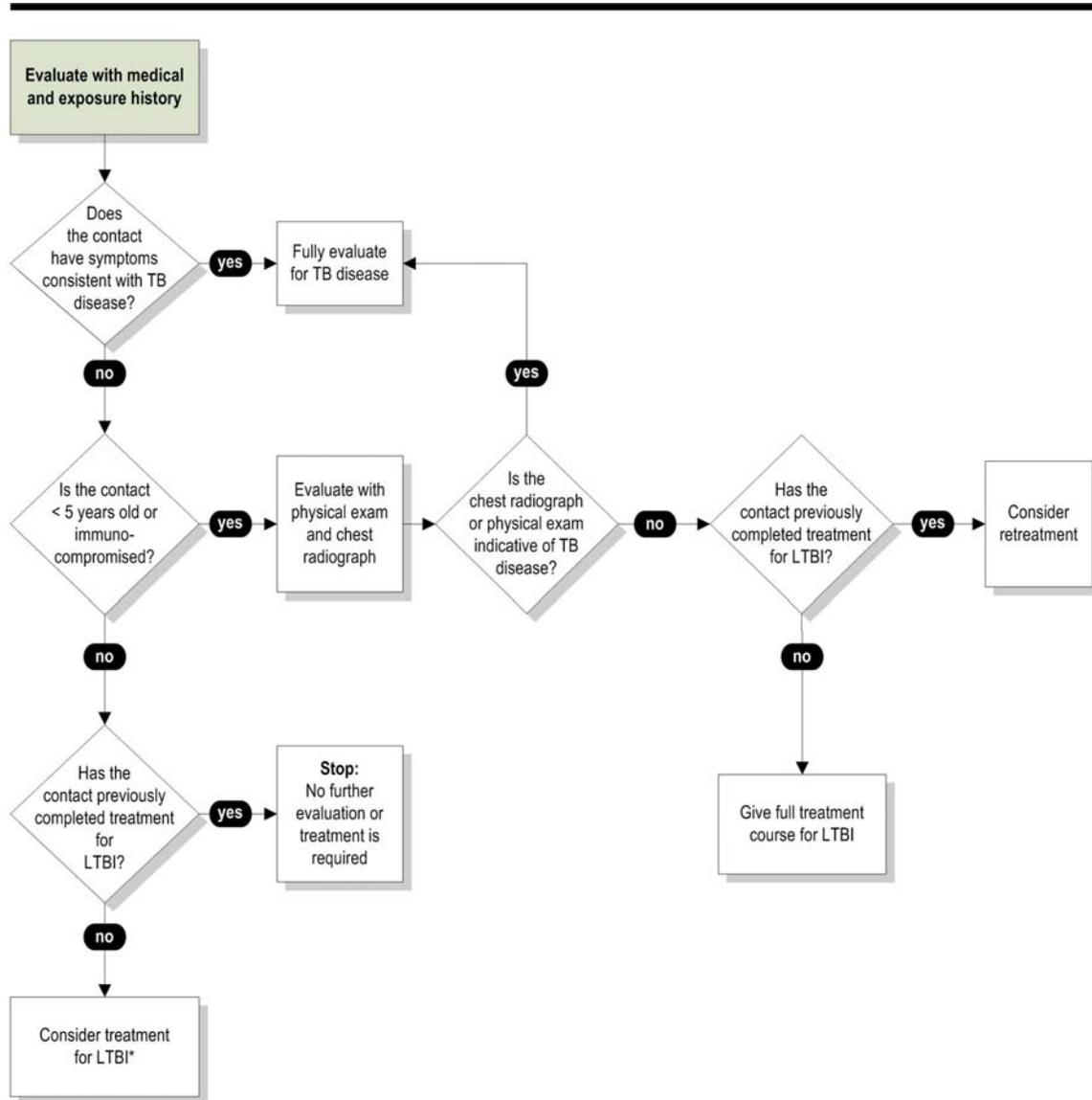
Definition of abbreviations: IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TST = tuberculin skin test.

Note: An IGRA may be used in place of a TST.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):17.

Contacts with Prior Positive Tuberculin Skin Tests

Figure 6: EVALUATION, TREATMENT, AND FOLLOW-UP OF CONTACTS WITH PRIOR POSITIVE TUBERCULIN SKIN TESTS⁵⁴



Definition of abbreviations: HIV = human immunodeficiency virus; LTBI = latent tuberculosis infection.

* Before initiation of treatment, contacts should be evaluated fully for TB disease. A full course treatment is recommended for HIV-infected contacts in this category.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):19.

When to Expand a Contact Investigation

Guidelines for Expanding an Investigation

Determine when to expand a contact investigation using the following guidelines:

1. Do not include lower-priority contacts unless objectives for high- and medium-priority contacts are being met.
2. Consider the extent of recent transmission.
3. Consider expanding the scope (e.g., number of contacts) of an investigation if any one or more of the following criteria are met:
 - a. Unexpectedly large rate of tuberculosis (TB) infection or disease in high-priority contacts. In general, national guidelines have defined such a rate as 10%, or at least twice the rate of a similar population without recent exposure, whichever is greater



Since the background prevalence of tuberculosis infection in adult foreign-born populations from high-incidence countries often exceeds 30%, it is important to stratify the infection rates by country of birth and/or length of residence and by age. For example, household contacts with a positive tuberculin skin test (TST) results are more likely to be infected recently (or as a result of exposure to the index patient) if the contacts are US-born children rather than adults born in high-incidence countries.

- b. Evidence of second-generation transmission (i.e., from TB patients who were infected after exposure to the source patient)
 - c. TB disease in any contacts who had been assigned low priority
 - d. Infection in any contacts younger than five years old
 - e. Contacts with change in TST status from negative to positive
4. When results from an investigation indicate that it should be expanded, but resources are insufficient, seek assistance from the next higher public health administrative level.

In general, without evidence of recent transmission, do not expand an investigation to lower-priority contacts. When program evaluation objectives have not been met, expand a contact investigation only in exceptional circumstances, generally involving highly infectious cases with high rates of infection among contacts or evidence for secondary cases and secondary transmission. Base the decision to expand an investigation on all data obtained from the investigation to that point in time. Without data from the initial contact investigation to support evidence of transmission, there is little support to expand to lower-priority contacts.

As in the initial investigation, review the incoming results of the expanded investigation at least weekly to reassess the strategy. Sometimes the result from an investigation indicates a need for expansion, but resources do not permit this. In these situations, seek consultation and assistance from the next higher level in public health administration (e.g., the county health department consults with the state health department). Consultation offers an objective review of strategy and results, additional expertise, and the potential for personnel or funds for meeting unmet needs.



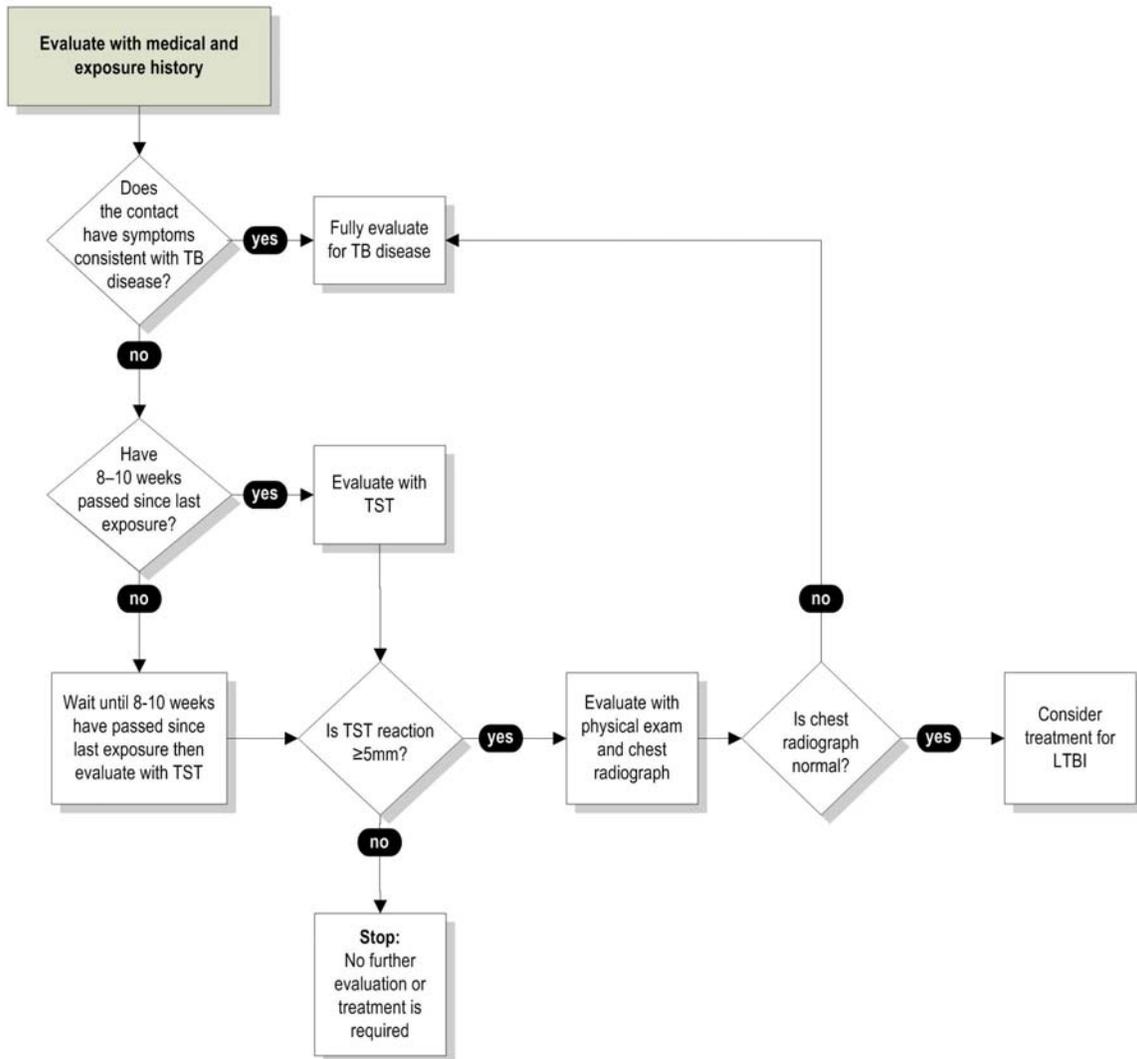
Contact the MDCH TB Control Program at 517-335-8165 to consult about expanding a contact investigation.



Record your decision and rationale for expanding a contact investigation in the index or source-case patient's chart.

Low-Priority Contacts

Figure 7: EVALUATION, TREATMENT, AND FOLLOW-UP OF LOW-PRIORITY CONTACTS⁵⁵



Definition of abbreviations: CXR = chest radiograph; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TST = tuberculin skin test.

* **Note:** An IGRA may be used in place of a TST.

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):18.

Data Management and Evaluation of Contact Investigations

Data collection related to contact investigations has three broad purposes:

1. Management of care and follow-up of individual index patients and contacts
2. Epidemiologic analysis of an investigation in progress as well as overall results of previous investigations
3. Program evaluation via performance indicators that reflect performance objectives

Reasons Contact Investigation Data Are Needed

Comprehensive Care

For each index patient and the associated contacts, a broad amount of demographic, epidemiologic, historical, and medical information is needed for providing comprehensive care. The care for these individuals can extend to longer than a year in some instances, so the information builds stepwise and has numerous longitudinal elements (e.g., clinic visits attended, treatment doses administered, and bacteriologic response to treatment).

Timeline Objectives

Many of these data elements also contribute to the other reasons for collecting data. Data on some process steps are necessary for monitoring whether the contact investigation is keeping to the timeline objectives (e.g., how soon after listing is the tuberculin skin test (TST) administered to a contact).

Completion of Investigation

When aggregated, the data from an investigation inform public health officials as to whether the investigation is on time and complete. The analysis of data also contributes to reassessments of the strategy used in the investigation (e.g., was the infection rate greater for contacts believed to have more exposure?).

Reassessment of Strategy

The data from a completed investigation and all investigations in a fixed period (e.g., six months) show achievements in meeting program objectives, such as observance of timelines and completion of therapy for infected contacts. These core measurements for program evaluation, however, cannot directly show why objectives were not met. If the data are structured and stored in formats allowing detailed retrospective review, then the reasons for problems can be studied.



To assess the overall activities of contact investigations, see the CDC's "Framework of Program Evaluation in Public Health" (*MMWR* 1999;48[No. RR-11]) at this hyperlink:

<ftp://ftp.cdc.gov/pub/Publications/mmwr/rr/rr4811.pdf>.

Approach

Follow a systematic, consistent approach to collect, organize, analyze, and disseminate data. CDC recommends, and MIACET and the MDCH TB Control Program support, the following recommendations for organizing evaluation contact investigation data and activities.

1. Collect specific data elements on index patients and their contacts. The data elements should permit calculation of program performance indices.
2. Collect data on standardized (paper or electronic) forms.
3. Supply data definitions and formats for use by persons who collect, use, and interpret contact investigation data.
4. Whenever feasible, use data definitions and formats that are standard among jurisdictions.
5. Store data electronically for quick analysis of interim results.
6. Implement policies for data management that enable quick analysis of interim results.
7. Implement policies for data management and storage that specify the assignment of responsibilities.
8. Implement training and policies for data accuracy, completeness, and security.
9. Periodically summarize and review data during a particular contact investigation and for overall contact investigations.
10. Evaluate programs for contact investigation activities at least annually. Evaluation is an integral part of TB program responsibility.
11. Beyond standard data elements shown in these guidelines, specific additional elements can contribute to local program management.

Index Patient and Contact Data



Use standardized forms to collect data for each index patient and their contacts. You may use one common form that is shared between the index and all associated contacts, or develop forms specific for patients and contacts, but the crucial point is to collect data in a standardized format. This will facilitate analysis of individual investigations as they progress, as well as aggregate or cohort analysis performed retrospectively. Tables 13 and 14 list data elements recommended by CDC, and is intended to assist local health departments in creating their own contact investigation forms.

Table 13: DATA ABOUT THE INDEX PATIENT⁵⁶

Identifiers/Demographic Information	<ul style="list-style-type: none"> ▪ Case manager ▪ Name and aliases ▪ For minors and dependents: guardian information ▪ Date of birth ▪ Social security number ▪ Current locating information and emergency contacts ▪ Residences during infectious period if unstably housed ▪ Sex ▪ Race ▪ Ethnicity ▪ Country of birth ▪ Time in United States, if foreign born ▪ Primary language and preferred language ▪ Methods of translation or interpretation
Transmission Settings and Associated Time Frames	<ul style="list-style-type: none"> ▪ Living situation(s) ▪ Employment or school ▪ Social/recreational activities ▪ Congregate settings (e.g., jail, homeless shelter) ▪ Substance abuse with social implications (e.g., crack cocaine)
Tuberculosis Information	<ul style="list-style-type: none"> ▪ Healthcare provider for TB (e.g., public health, private, both, other) ▪ Anatomic site of disease ▪ Symptoms and their dates ▪ CXR results, presence of cavity ▪ TB medications with start and stop dates ▪ Bacteriologic results (sputum smear, culture, drug susceptibility) with dates ▪ Previous history of TB disease and treatment ▪ Infectious period (updated as new information arrives)

Contact Investigation	<ul style="list-style-type: none"> ▪ HIV infection status ▪ HIV/AIDS registry number
	<ul style="list-style-type: none"> ▪ Date of initial interview with index patient ▪ Dates of follow-up interviews with index patient
<p>Definitions of abbreviations: AIDS = acquired immunodeficiency syndrome; CXR = chest radiograph; HIV = human immunodeficiency virus; RVCT = <i>Reports of Verified Cases of Tuberculosis</i>; TB = tuberculosis.</p>	

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON®-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.

Table 14: DATA ABOUT EACH CONTACT⁵⁷

Investigator and Dates	<ul style="list-style-type: none"> ▪ Contact manager or investigator ▪ Date listed ▪ How or why the contact was listed (e.g., named by index patient) ▪ Dates of interviews ▪ Start and end dates for exposure (updated as new information arrives)
Identifiers	<ul style="list-style-type: none"> ▪ Name and aliases ▪ For minors and dependents: guardian information ▪ Social security number ▪ Date of birth ▪ Locating information and emergency contacts ▪ Sex ▪ Race ▪ Ethnicity ▪ Country of birth ▪ Time in the United States, if foreign born ▪ Primary language and preferred language ▪ Methods of translation or interpretation
Exposure	<ul style="list-style-type: none"> ▪ Relationship/connection to the index patient ▪ Social affiliations (e.g., work, school, church, clubs, activities) ▪ Environmental information about exposure settings (e.g., size, ventilation) ▪ Frequency, duration, and time frame of interactions
Medical History and Risk Factors	<ul style="list-style-type: none"> ▪ Prior history of TB disease or LTBI, and documentation ▪ BCG vaccination and date ▪ Medical risk factors for progression of infection to TB disease[†] ▪ Population risk factors for prevalent <i>M. tuberculosis</i> infection[†]

Evaluation for Tuberculosis Disease and Latent Tuberculosis Infection	<ul style="list-style-type: none"> ▪ Healthcare provider for TB (e.g., public health, private, both, other) ▪ Symptoms suggesting TB disease ▪ TSTs, with dates, reagents and lot numbers, reaction measurement ▪ IGRA results ▪ CXR results with dates ▪ Bacteriologic results with dates ▪ HIV infection status ▪ Final diagnostic classifications for LTBI or TB disease
Treatment Information for Contacts with Latent Tuberculosis Infection	<ul style="list-style-type: none"> ▪ Dates of treatment ▪ Treatment regimen (medications, dosing schedule, any changes to these) ▪ Methods of supervising treatment (DOT, etc.) ▪ Adverse reactions (specify each) ▪ Interruptions in regimen and dates ▪ Outcome of treatment (completion, etc., consistent with <i>ARPE</i>[†]) ▪ If treatment not completed, reason[†]
<p>Definitions of abbreviations: <i>ARPE</i> = <i>Aggregate Report for Program Evaluation</i>; BCG = bacille Calmette-Guérin; CXR = chest radiograph; DOT = directly observed therapy; HIV = human immunodeficiency virus; IGRA = interferon gamma release assay; LTBI = latent tuberculosis infection; TB = tuberculosis; TST = tuberculin skin test.</p> <p>[†] As defined by CDC <i>ARPE</i> for contact investigations.</p>	

Source: CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.

Evaluation of a Contact Investigation

Summarize the results of a contact investigation to report by priority the total number of contacts who were identified, were tested, started therapy, and completed therapy.



Record data from your evaluation of contacts in the Contact Information page of the index or source case's RVCT form in the MDSS.

In addition, the CDC's Framework for Program Evaluation in Public Health is recommended for assessing the overall activities of contact investigations.⁵⁸ The MDCH TB Control Program is required to report yearly on the investigation, evaluation and treatment of contacts to culture-confirmed cases. This data is reported in aggregate using the form "Aggregate Report for Tuberculosis Program Evaluation: Follow-up and Treatment for Contacts to Tuberculosis Cases" (ARPE). The MDCH TB Control Program will prepare ARPE forms for each local health department that reported any culture-confirmed cases during the prior calendar year, indicating the total number of

sputum smear-positive and sputum smear-negative culture-confirmed cases reported by the local health department. The local health department is then responsible for indicating the total number of contacts identified in that calendar year and the evaluation, follow-up and disposition of all contacts in aggregate.



For information about the *ARPE* form, see the CDC's *Aggregate Reports for Tuberculosis Program Evaluation: Training Manual and User's Guide*. (Atlanta, GA: US Department of Health and Human Services, CDC; 2005) at this hyperlink: http://www.cdc.gov/tb/pubs/PDF/ARPEs_manual.pdf .



For more information on using this evaluation framework, see the CDC Program Evaluation Workgroup's Web site at this hyperlink: <http://www.cdc.gov/eval/framework.htm> .

Outbreak Investigation

If data from a contact investigation or surveillance indicate a potential outbreak, conduct an outbreak investigation. A tuberculosis (TB) outbreak warns of potential extensive transmission. An outbreak implies that (1) a TB patient was contagious, (2) contacts were exposed significantly, and (3) the interval since exposure has been sufficient for infection to progress to disease. An outbreak investigation involves several overlapping contact investigations, with a surge in the need for public health resources. More emphasis on active case finding is recommended, which sometimes means that more contacts than usual should have chest radiographs and specimen collection for mycobacteriology.

Definition of a Tuberculosis Outbreak

Definitions for a TB outbreak are relative to the local context. Outbreak cases can be distinguished from other cases only when certain associations in time, location, patient characteristics, or *Mycobacterium tuberculosis* attributes (e.g., drug resistance or genotype) become apparent. In low-incidence jurisdictions, any temporal cluster is suspicious for an outbreak. A working definition of a potential TB outbreak is helpful for planning and response, and may include any of the following six criteria:

Criteria based on surveillance and epidemiology:

1. An increase has occurred above the expected number of TB cases.
2. During and because of a contact investigation, two or more contacts are identified as having TB disease, regardless of their assigned priority (i.e., high, medium, or low priority).
3. Any two or more cases occurring within one year of each other are discovered to be linked, and the linkage is established outside of a contact investigation (e.g., two patients who received a diagnosis of TB disease outside of a contact investigation are found to work in the same office and only one or neither of the persons was listed as a contact to the other).
4. A genotype cluster leads to discovery of one or more verified transmission links that were missed during a contact investigation within the prior two years.

Criteria based on program resources:

5. Transmission is continuing despite adequate control efforts by the TB control program.
6. Contact investigation associated with increased cases requires additional outside help.

Deoxyribonucleic Acid Genotyping

Deoxyribonucleic acid (DNA) genotyping is a laboratory technique used by public health officials to distinguish between different strains of *M. tuberculosis* and to help assess the likelihood of TB transmission. Characterization of *M. tuberculosis* with DNA genotyping is a powerful tool for the following:

1. Surveillance of potential outbreaks
2. Confirming TB cases linked by traditional epidemiologic methods
3. Identifying clusters of patients infected with genetically related or identical strains of *M. tuberculosis* and determining common sources of infections
4. Guiding contact investigations and the appropriate use of preventive therapy
5. Identifying laboratory cross-contamination as the cause of misdiagnosis

When used to track the transmission of a specific strain, DNA genotyping can help assess the effectiveness of TB control programs, a particularly useful methodology for areas with low TB incidence as the United States approaches TB elimination.

Confirm the linkage between cases by genotyping results if isolates have been obtained. An outbreak increases the urgency of investigations and will put greater demands on the health department. Therefore, corroborate a suspected linkage between cases by genotyping results before intensifying an investigation. An epidemiologic investigation is required for determining probable transmission linkages even if genotypes match.

Any secondary case that is unexpectedly linked to a known index patient represents a potential failure in the contact investigation; in such cases, reassess the original investigation to determine whether the strategy for finding contacts was optimal and whether the priorities were valid. If a secondary case occurred because treatment for a known contact with latent tuberculosis infection (LTBI) was not started or completed, then review the strategies for treatment and completion.

Resources and References

Resources

- California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). "Contact Investigation Guidelines" (*CDHS/CTCA Joint Guidelines*; 1998). Available at: <http://www.ctca.org/guidelines/IID1contactinvestigation.pdf> .
- CDC. *Aggregate Reports for Tuberculosis Program Evaluation: Training Manual and User's Guide* (Atlanta, GA; 2005). Available at: http://www.cdc.gov/TB/publications/PDF/ARPEs_manualsm1.pdf
- CDC. *Effective TB Interviewing for Contact Investigation: Self-Study Modules*. (Atlanta, GA; 2006). Available at: <http://www.cdc.gov/tb/publications/guidestoolkits/Interviewing/selfstudy/default.htm>
- CDC. "Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis: Recommendations from the National Tuberculosis Controllers Association and CDC" (*MMWR* 2005;54 [No. RR-15]). Available at: <http://www.cdc.gov/mmwr/pdf/rr/rr5415.pdf> .
- CDC. "Goal II: accelerate the decline" (*CDC's Response to Ending Neglect: The Elimination of Tuberculosis in the United States*). Available at: <http://www.cdc.gov/tb/publications/reportsarticles/iom/iomresponse/lead.htm>
- CDC Evaluation Workgroup. Framework for Program Evaluation (CDC Web site). Available at: <http://www.cdc.gov/eval/framework.htm> .
- New Jersey Medical School National Tuberculosis Center. *Performance Guidelines: A Supervisor's Guide for the Development and Assessment of TB Field Investigation Skills* (New Jersey Medical School Global Tuberculosis Institute Web site; 2004). Available at: <http://www.umdnj.edu/globaltb/products/performanceguide.htm> .
- New Jersey Medical School National Tuberculosis Center. *Performance Guidelines for Contact Investigation: The TB Interview* (New Jersey Medical School Global Tuberculosis Institute Web site). Available at: <http://www.umdnj.edu/globaltb/products/tbinterview.htm> .

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):35.
- ² ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):35.
- ³ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.

-
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):3.
- ⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):4.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
- ⁷ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):17.
- ⁸ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.
- ⁹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):5, 6.
- ¹⁰ CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:10. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006; CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):6.
- ¹¹ CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:10. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006.
- ¹² CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9.
- ¹³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.
- ¹⁴ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.
- ¹⁵ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.
- ¹⁶ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):4.
- ¹⁷ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):51.
- ¹⁸ CDC. Racial/ethnic disparities in diagnoses of HIV/AIDS—33 states, 2001–2004. *MMWR* 2006;55(No. 5):121–125.
- ¹⁹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):5.
- ²⁰ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7–8, 43.
- ²¹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9.
- ²² CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9.
- ²³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):11.
- ²⁴ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):11.
- ²⁵ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):11.

-
- ²⁶ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Contact investigation guidelines. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. November 12, 1998:18. Available at: <http://www.ctca.org/guidelines/IIID1contactinvestigation.pdf> . Accessed July 6, 2006.
- ²⁷ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.
- ²⁸ CDC. Aggregate reports for tuberculosis program evaluation: training manual and user's guide. Atlanta, GA: US Department of Health and Human Services, CDC; 2005. Available at: http://www.cdc.gov/tb/pubs/PDF/ARPEs_manual.pdf .
- ²⁹ CDC. *Effective TB Interviewing for Contact Investigation: Self-Study Modules*. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention, Division of Tuberculosis Elimination; 2006:4. Available at: http://www.cdc.gov/tb/pubs/Interviewing/selfstudy/pdf/tbinterviewing_ssmodules.pdf . Accessed July 6, 2006.
- ³⁰ California Department of Health Services, Tuberculosis Control Branch; California Tuberculosis Controllers Association. Contact investigation guidelines. Berkeley, CA: California Department of Health Services; 1998; in CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7.
- ³¹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7.
- ³² CDC. *Effective TB Interviewing for Contact Investigation: Self-Study Modules*. Atlanta, GA: Department of Health and Human Services Centers for Disease Control and Prevention Division of Tuberculosis Elimination; 2006:4.
- ³³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):7.
- ³⁴ Adapted from New Jersey Medical School National Tuberculosis Center. *TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker* [New Jersey Medical School Global Tuberculosis Institute Web site]. 2004:3–17. Available at: <http://www.umdnj.edu/globaltb/products/tbinterviewing.htm> . Accessed July 6, 2006.
- ³⁵ Adapted from New Jersey Medical School National Tuberculosis Center. *TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker* [New Jersey Medical School Global Tuberculosis Institute Web site]. 2004:3–17. Available at: <http://www.umdnj.edu/globaltb/products/tbinterviewing.htm> . Accessed July 6, 2006.
- ³⁶ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):6.
- ³⁷ Adapted from New Jersey Medical School National Tuberculosis Center. *TB Interviewing for Contact Investigation: A Practical Resource for the Healthcare Worker* [New Jersey Medical School Global Tuberculosis Institute Web site]. 2004:3–17. Available at: <http://www.umdnj.edu/globaltb/products/tbinterviewing.htm> . Accessed July 6, 2006.
- ³⁸ CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006.
- ³⁹ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):10.
- ⁴⁰ CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006.
- ⁴¹ CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006.
- ⁴² CDC. Module 6: contact investigations for tuberculosis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:18. Available at: <http://www.phppo.cdc.gov/phtn/tbmodules/Default.htm> . Accessed July 11, 2006.
- ⁴³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9.
- ⁴⁴ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):10–11.
- ⁴⁵ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9.

-
- ⁴⁶ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):9–10.
- ⁴⁷ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54 (No. RR-15):12.
- ⁴⁸ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54 (No. RR-15):13.
- ⁴⁹ CDC. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):14.
- ⁵⁰ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):11.
- ⁵¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.
- ⁵² CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):15.
- ⁵³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):17.
- ⁵⁴ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):19.
- ⁵⁵ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):18.
- ⁵⁶ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.
- ⁵⁷ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):21.
- ⁵⁸ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis: recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):22.

Infection Control

CONTENTS

Introduction.....	12.2	Hospital Discharge	12.19
Purpose.....	12.2	Drug-susceptible tuberculosis disease.....	12.19
Policy	12.3	Multidrug-resistant tuberculosis disease	12.20
State Laws and Regulations.....	12.3	Release settings.....	12.20
Hierarchy of Infection		Residential Settings.....	12.21
Control Measures	12.4	Administrative controls in the patient's home..	12.21
Administrative controls.....	12.4	Environmental controls in the patient's home..	12.22
Environmental controls	12.6	Respiratory protection in the patient's home ...	12.22
Personal respiratory protection	12.7	Other residential settings.....	12.23
Who Should Use a		Return to Work, School,	
Mask or Respirator	12.10	or Other Social Settings.....	12.24
Two-Step Tuberculin Skin Testing....	12.11	Drug-susceptible tuberculosis disease.....	12.24
Isolation	12.13	Multidrug-resistant tuberculosis disease	12.25
Estimating infectiousness	12.14	Tuberculosis Infection Control in	
Determining noninfectiousness.....	12.14	Patient Care Facilities	12.26
Airborne Infection Isolation		Transportation Vehicles.....	12.28
in a Healthcare Facility.....	12.16	Patient self-transport	12.28
When to initiate airborne infection isolation	12.16	Transport by healthcare workers.....	12.28
When to discontinue airborne infection		Transport by emergency medical services.....	12.28
isolation	12.17	Resources and References.....	12.29

Introduction

Purpose

Use this section to understand and follow national and Michigan guidelines to do the following:

- Review the hierarchy of infection control measures and know where to go for further information.
- Alert local public health staff to the basic differences between masks and respirators.
- Estimate patients' infectiousness and determine when patients are noninfectious.
- Determine when to isolate patients, when to discharge them from hospitals, and when to permit them to return to work, school, or other settings.
- Review how to implement infection control measures in residential settings, patient care facilities, and transportation vehicles.
- Consult with facilities that are implementing infection control measures, including two-step testing.

In the 2005 guidelines, "Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, Centers for Disease Control and Prevention, and the Infectious Diseases Society of America," one of the recommended strategies to achieve the goal of reducing tuberculosis (TB) morbidity and mortality is the identification of settings in which a high risk exists for transmission of *Mycobacterium tuberculosis* and application of effective infection control measures.¹

As TB continues to decline in most areas of the United States, it is crucial that state and local public health agencies provide facilities with epidemiologic data on TB, as well as education and guidance in developing effective TB infection control programs.

Infection control measures are fundamental to reducing the spread of communicable diseases such as TB. Transmission of *M. tuberculosis* from person to person can occur in many locations, such as home, work, school, and healthcare facilities.² It is impossible to prevent all exposure; however, the goal is to reduce the amount of transmission.

Each agency's or facility's program should include a hierarchy of administrative controls, environmental controls, and personal respiratory protection. Because each patient care setting and patient's home is different, each program will incorporate a different combination of control activities. The extent to which each agency or facility implements its control activities is based on the results of its risk assessment. In areas where TB rates are lower, the TB risk is lower, and this should affect which elements of the TB infection control plan are utilized.

Policy

For infection control, state and local public healthcare agencies need to address TB control in these three areas:

1. Healthcare facilities, where persons with infectious TB disease would seek care^{3,4}
2. Congregate settings and residential facilities, whose residents are at increased risk for TB disease^{5,6}
3. The patient's home

To accomplish TB control activities, each local public healthcare agency should do the following:

1. Familiarize staff with the current Centers for Disease Control and Prevention (CDC) infection control guidelines for healthcare providers and settings.
2. Develop an infection control program for the county or state TB staff that addresses these issues:
 - a. Assignment of responsibility for the program
 - b. Risk assessment
 - c. Persons (if any) who need baseline testing, including TB screening and counseling
 - d. Education and training
 - e. Case management (if direct patient care is provided)
3. Designate a staff person to guide facilities that may need to set up TB infection control programs.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

State Laws and Regulations

[MI OSHA: Enforcement Policy and Procedures for Evaluating Occupational Exposure to TB](http://www.dleg.state.mi.us/wsh/docs/inst/gishd_com_05_2r2.doc) (May 22, 2007) can be found at http://www.dleg.state.mi.us/wsh/docs/inst/gishd_com_05_2r2.doc

Hierarchy of Infection Control Measures

There are three types of infection control measures. The first are administrative controls, which are primarily aimed at early identification, isolation, and appropriate treatment of infectious patients. The second are environmental controls, which focus on preventing the spread and reducing the concentration of infectious droplet nuclei in the air.⁷ The third is personal respiratory protection, which may provide additional protection for healthcare workers in high-risk settings such as isolation rooms and cough-inducing or aerosol-generating suites.

The activities described below are more relevant to infection control in healthcare or residential facilities. Home settings are discussed separately in the “Residential Settings” topic in this section.

Administrative Controls

Administrative control measures are the first of three levels of measures designed to reduce the risk of tuberculosis (TB) transmission. Administrative controls are the first level of infection control because they include a variety of activities to identify, isolate, and appropriately treat persons suspected of having TB disease.

An effective TB infection control plan contains measures for reducing the spread of TB that are appropriate to the risk of a particular setting.⁸ Every healthcare setting should have a TB infection control plan that is part of an overall infection control program.⁹ A written TB infection control plan helps to ensure prompt detection, airborne precautions, and treatment of persons who have suspected or confirmed TB disease.¹⁰

- **In TB infection control programs for settings in which patients with suspected or confirmed TB disease are expected to be encountered,** develop a written TB infection control plan that outlines a protocol for the prompt recognition and initiation of airborne precautions for persons with suspected or confirmed TB disease, and update it annually.¹¹
- **In TB infection control program for settings in which patients with suspected or confirmed TB disease are NOT expected to be encountered,** develop a written TB infection control plan that outlines a protocol for the prompt recognition and transfer of persons who have suspected or confirmed TB disease to another healthcare setting. The plan should indicate procedures to follow to separate persons with suspected or confirmed infectious TB disease from other persons in the setting until the time of transfer. Evaluate the plan annually, if possible, to ensure that the setting remains one in which persons who have suspected or confirmed TB disease are not encountered and that they are promptly transferred.¹²

Administrative Activities¹³

Key activities to reduce the risk of transmission include the following:

1. **Assign responsibility** to a specific person for designing, implementing, evaluating, and maintaining a TB infection control program for that facility.
2. **Conduct a risk assessment.** The risk level of a particular facility is the basis for determining all other activities and will result in each facility having a plan designed specifically for that facility.
3. **Develop, implement, and enforce policies and procedures** to ensure early identification, evaluation, and treatment of infectious cases of TB.
4. **Provide prompt triage** and management in the outpatient setting of patients who may have infectious TB.
5. **Promptly initiate and maintain TB isolation** for persons who may have infectious TB and are admitted to an inpatient setting.
6. **Plan effectively for the discharge** of the patient, coordinating between the local public health agency and the healthcare provider.
7. **Implement environmental controls.** Develop, install, maintain, and evaluate the effectiveness of engineering controls.
8. **Implement a respiratory protection program.** Develop, initiate, install, maintain, and evaluate the effectiveness of the respiratory protection program.
9. **Implement precautions for cough-inducing procedures.** Develop, implement, and enforce policies and procedures to ensure adequate precautions when performing cough-inducing procedures.
10. **Educate and train healthcare workers** about TB.
11. **Counsel and screen healthcare workers.** Develop and implement counseling and screening program for healthcare workers in regard to TB disease and latent TB infection (LTBI).
12. **Promptly evaluate possible episodes of TB transmission.**
13. **Coordinate activities** between the state and local public healthcare agencies.

Environmental Controls

TB is caused by an organism called *Mycobacterium tuberculosis*. When a person with infectious TB disease coughs or sneezes, tiny particles called droplet nuclei that contain *M. tuberculosis* are expelled into the air.¹⁴ Environmental controls are used to prevent the spread and reduce the concentration of infectious droplet nuclei.¹⁵ Each facility should use different combinations of environmental controls, based on the results of its risk assessment.

It is important to note, however, that without strong administrative controls, environmental controls are ineffective because cases would not be recognized or managed appropriately.

Table 1 describes the three main types of environmental controls.

Table 1: THREE TYPES OF ENVIRONMENTAL CONTROLS

Most Effective Control	Ventilation <ul style="list-style-type: none">▪ Controls direction of air flow to prevent contamination of air in areas surrounding a person with infectious tuberculosis (TB).▪ Dilutes and removes contaminated air.▪ Exhausts contaminated air to the outside.
Supplementary Controls	High-efficiency particulate air (HEPA) filtration <ul style="list-style-type: none">▪ Cleans the air of infectious droplet nuclei. Ultraviolet germicidal irradiation (UVGI) <ul style="list-style-type: none">▪ Kills or inactivates TB bacilli in the air.

Personal Respiratory Protection

Although administrative controls and environmental controls are most effective in controlling the spread of TB, they do not eliminate the risk of transmission entirely. Personal respiratory protection, the third level of infection control, is also used in higher-risk settings.

The purpose of a respirator is to reduce exposure by filtering out TB bacilli from room air before the air is breathed into a person's lungs. Respirators used for TB control should be approved for TB use by the National Institute for Occupational Safety and Health (NIOSH).

It is recommended that healthcare provider staff and visitors use personal respiratory protective equipment in settings that may be at higher risk for TB transmission, such as the following:

- Rooms where infectious TB patients are being isolated
- Areas where cough-inducing or aerosol-generating procedures are performed
- Other areas, which should be identified in the facility's risk assessment, where administrative and environmental controls are not likely to protect persons from inhaling infectious droplet nuclei

It is important to note that the precise level of effectiveness (of respiratory protection) in protecting healthcare workers from *M. tuberculosis* transmission in healthcare settings has not been determined.¹⁶



Surgical-type masks are to be used by persons who are infectious or are suspected cases of TB disease when they are out of TB respiratory isolation. The purpose of the mask is to reduce transmission by reducing the number of TB bacilli coughed out into the room air. The infectious patient should not wear a respirator. For more information, see Table 2: **Using Masks and Respirators.**

When TB respirators are used, a respiratory protection program should be developed and enforced.¹⁷ For more information regarding respiratory protection programs, see the Centers for Disease Control and Prevention's (CDC's) "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005" (*MMWR* 2005;54[No. RR-17]:75–79) at this hyperlink: <http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .

CDC guidelines recommend that healthcare facilities conduct annual training regarding multiple topics for healthcare workers (HCWs), including the nature, extent, and hazards of TB disease in the healthcare setting. The training can be conducted in conjunction with other related training regarding infectious disease associated with airborne transmission.

In addition, training topics should include the following:

1. Risk assessment process and its relation to the respirator program, including signs and symptoms used to indicate that respirators are required in certain areas and the reasons for using respirators
2. Environmental controls used to prevent the spread and reduce the concentration of infectious droplet nuclei
3. Selection of a particular respirator for a given hazard (See “Selection of Respirators” on p. 78 of the CDC guidelines at this hyperlink: <http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .)
4. Operation, capabilities, and limitations of respirators
5. Cautions regarding facial hair and respirator use
6. Occupational Health and Safety Administration (OSHA) regulations regarding respirators, including assessment of employees' knowledge

Trainees should be provided opportunities to handle and wear a respirator until they become proficient. Trainees should also be provided with copies or summaries of lecture materials for use as references and instructions to refer all respirator problems immediately to the respiratory program administrator.¹⁸

A fit test is used to determine which respirator fits the user adequately and to ensure that the user knows when the respirator fits properly. Fit testing provides a means to determine which respirator model and size fits the wearer best and to confirm that the wearer can don the respirator properly to achieve a good fit. Periodic fit testing for respirators used in TB environments can serve as an effective training tool in conjunction with the content included in employee training and retraining.¹⁹

The CDC recommends that, after a risk assessment to validate the need for respiratory protection, a healthcare facility should perform fit testing during the initial respiratory protection program training and periodically thereafter in accordance with federal, state, and local regulations.²⁰ Additional fit testing should be considered in the following situations: 1) risk of transmission of *M. tuberculosis*, 2) changes in facial features of the wearer, 3) development of a medical condition that would affect respiratory function, 4) change in the appropriate physical characteristics of the respirator (despite the same model number), or 5) change in the model or size of the assigned respirator.²¹

OSHA addresses general respiratory protection requirements and the need for the following:

- Respiratory protection program
- Amended medical evaluation
- Training and recordkeeping
- Annual fit testing
- Fit checking

For regulations in your area, refer to state and local regulations and contact your local OSHA office.²²

Who Should Use a Mask or Respirator

Using masks and respirators properly can reduce transmission of *Mycobacterium tuberculosis* and exposure to TB. Refer to Table 2: **Using Masks and Respirators** to determine when to use masks and respirators.

Table 2: USING MASKS AND RESPIRATORS²³

Mask (a regular "surgical" mask*)	Respirator (NIOSH-approved, N-95 or higher*)
<p>Purpose To reduce transmission by capturing infectious droplet nuclei that an infectious patient releases before they get into the air.</p>	<p>Purpose To reduce exposure by filtering infectious droplet nuclei out of the air, before wearers breathe the air into their lungs.</p>
<p>Who should wear a mask?</p> <ul style="list-style-type: none"> ▪ Patients with infectious TB or suspected infectious TB 	<p>Who should wear a respirator?</p> <ul style="list-style-type: none"> ▪ Staff ▪ Visitors to TB isolation rooms (keep these visitors to a minimum)
<p>A patient should wear a mask in a hospital setting when:</p> <ul style="list-style-type: none"> ▪ Suspected of having infectious TB and not yet placed in respiratory isolation ▪ Leaving a respiratory isolation room for any reason <p>Note: Infectious patients should NOT wear masks when in their TB isolation rooms.</p> <p>A patient should wear a mask in a health clinic setting when:</p> <ul style="list-style-type: none"> ▪ Not in a TB isolation room ▪ Returning to the clinic for evaluation 	<p>A staff person or visitor should wear a respirator in a hospital or clinic setting when:</p> <ul style="list-style-type: none"> ▪ Entering a TB isolation room ▪ Performing cough-inducing or aerosol-generating procedures ▪ Unlikely to be protected by administrative or environmental controls
<p>A patient should wear a mask in a transportation setting when:</p> <ul style="list-style-type: none"> ▪ Traveling in a vehicle with other persons 	<p>A staff person or visitor should wear a respirator in some transportation settings when:</p> <ul style="list-style-type: none"> ▪ Riding in a vehicle with a patient with infectious TB
<p>In the patient's home:</p> <p>Note: Infectious patients do NOT need to wear a mask when they are in their homes.</p>	<p>A staff person or visitor* should wear a respirator in a patient's home when:</p> <ul style="list-style-type: none"> ▪ Visiting the infectious patient inside the home/residence <p>Note: There should NOT be any visitors (excluding protected healthcare workers) to the home until the patient is released from TB isolation.</p>
<p>Definition of abbreviations: NIOSH = National Institute for Occupational Safety and Health; TB = tuberculosis. * There are some devices, such as the 3M 1860, which are both N95 respirators and surgical masks.</p>	

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):38–40.

Two-Step Tuberculin Skin Testing

Two-step testing is used to improve the interpretation of tuberculin skin tests (TSTs), especially in persons who are required to undergo periodic testing. Two-step testing should be used for the **initial** skin testing of adults who will be retested periodically, such as healthcare workers.²⁴

In some persons who are infected with *Mycobacterium tuberculosis*, delayed-type hypersensitivity to tuberculin may wane over the years. When these persons are skin tested many years after their infection, they may have a negative reaction.

However, the skin test may have stimulated (boosted) their ability to react to tuberculin, causing a positive reaction to subsequent tests. This boosted reaction may be misinterpreted as a new infection. The booster phenomenon may occur at any age, but its frequency increases with age and is highest among older persons. Boosted reactions may occur in persons infected with nontuberculous mycobacteria or in persons who have had a prior bacille Calmette-Guérin (BCG) vaccination.

A positive reaction to the second test should be interpreted as evidence for infection with *M. tuberculosis*. On the basis of this second test result, the person should be classified as previously infected and cared for accordingly. This would not be considered a skin test conversion.

If the first and second test results are negative, the person should be classified as uninfected. In these persons, a positive reaction to any subsequent test is likely to represent new infection with *M. tuberculosis* (a skin test conversion).

Schedule appointments for two-step testing as shown below.



Refer to the topics on administration, measurement, and interpretation of the tuberculin skin test in the Diagnosis of Latent Tuberculosis Infection section.

Table 3: FOUR APPOINTMENT SCHEDULE FOR TWO-STEP TESTING

Appointments	Tasks
First appointment	Apply the first tuberculin skin test (TST).
Second appointment 48 to 72 hours after applying the first TST	Measure the reaction. <ul style="list-style-type: none"> ▪ If the reaction is negative, schedule a third appointment. ▪ If the reaction is positive, do not repeat the TST. Obtain a chest radiograph.
Third appointment 1 to 3 weeks after measurement of the first TST	Re-apply the TST. <ul style="list-style-type: none"> ▪ Use the same dose and strength of tuberculin. Inject the tuberculin on the other forearm, or at least 5 cm from the original test site. ▪ If the reaction is negative and the patient returns over a week after the first TST was applied, apply the second TST.
Fourth appointment 48 to 72 hours after applying the second TST	Measure the reaction. <ul style="list-style-type: none"> ▪ If the reaction is negative, classify the individual as uninfected. ▪ If the reaction is positive, obtain a chest radiograph.



For more information on two-step testing, refer to the CDC's "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Facilities, 2005" (*MMWR* 2005;54[No. RR-17]) at this hyperlink:

<http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .

Isolation

To reduce disease transmission, a patient with tuberculosis (TB) disease may need to be isolated or have activities restricted.

Isolation: Isolation is used when people are ill. Isolation of people who have a specific illness separates them from healthy people and restricts their movement to stop the spread of that illness. Isolation allows for the focused delivery of specialized health care to people who are ill, and it protects healthy people from getting sick. People in isolation may be cared for in their homes, in hospitals, or at designated healthcare facilities. Isolation is a standard procedure used in hospitals today for patients with TB. In most cases, isolation is voluntary; however, many levels of government (federal, state, and local) have the basic legal authority to compel isolation of sick people to protect the public.²⁵

Restricted Activities: Until determined to be noninfectious, the patient is not permitted to return to work, school, or any social setting where the patient could expose individuals to airborne bacteria.

Quarantine: Although TB control programs have used the word “quarantine” interchangeably with “isolation” and “restricted activities,” the word “quarantine” properly used is not a term applicable to TB control. Quarantine applies to people who have been exposed and may be infected but are not yet ill. Separating exposed people and restricting their movements is intended to stop the spread of illness. Quarantine is not an appropriate TB control measure for asymptomatic, exposed individuals.²⁶



For information on diagnosis and laboratory tests, refer to the sections on diagnosis of tuberculosis disease and latent tuberculosis infection. For information on guidelines for infection control in the patient’s residence, group settings, and during transportation of a patient, see the subtopics that follow.

Estimating Infectiousness

In general, patients who have suspected or confirmed TB disease and who are not on antituberculosis treatment should be considered infectious if characteristics include the following:

- Presence of cough
- Cavitation on chest radiograph
- Positive acid-fast bacilli (AFB) sputum smear result
- Respiratory tract disease with involvement of the lung or airways, including larynx
- Failure to cover the mouth and nose when coughing
- Undergoing cough-inducing or aerosol-generating procedures (e.g., sputum induction, bronchoscopy, airway suction)²⁷

If a patient with one or more of these characteristics is on standard multidrug therapy with documented clinical improvement, usually in connection with smear conversion over several weeks, the risk of infectiousness is reduced.²⁸

Determining Noninfectiousness

Use the following criteria as general guidelines to determine when during therapy a patient with pulmonary TB disease has become noninfectious. Decisions about infectivity of a person on treatment for TB should depend on the extent of illness and the specific nature and circumstances of the contact between the patient and exposed persons. These guidelines can and should be modified on a case-by-case basis by a qualified public health officer.

- The patient has negligible likelihood of multidrug-resistant TB (no known exposure to multidrug-resistant tuberculosis and no history of prior episodes of TB with poor compliance during treatment).
- The patient has received standard multidrug antituberculosis therapy for two to three weeks. (For patients with AFB sputum smear results that are negative or rarely positive, the threshold for treatment is four to seven days.)
- The patient has demonstrated complete adherence to treatment (e.g., is receiving directly observed therapy).
- The patient has demonstrated evidence of clinical improvement (e.g., reduction in the frequency of cough or reduction of the grade of the AFB sputum smear result).

- All close contacts of the patient have been identified, evaluated, advised, and, if indicated, started on treatment for latent TB infection. This criterion is critical, especially for children younger than five years of age and persons of any age with immunocompromising health conditions such as human immunodeficiency virus (HIV) infection.
- While in the hospital for any reason, patients with pulmonary TB should remain in airborne infection isolation until the following occurs:
 - Receipt of standard multidrug antituberculosis therapy
 - Demonstrated clinical improvement
 - Three consecutive AFB-negative smear results from sputum specimens collected eight to 24 hours apart, with at least one being an early morning specimen

Hospitalized patients returning to a congregate setting (e.g., a homeless shelter or detention facility) should have three consecutive AFB-negative smear results of sputum specimens collected more than eight hours apart before being considered noninfectious.²⁹ At least one of these specimens should be collected early in the morning.

Airborne Infection Isolation in a Healthcare Facility

In airborne infection isolation (AII), the patient is placed in an AII room, usually within a hospital or healthcare facility. The main characteristics of an AII room (for new or renovated buildings) are that it has negative air pressure relative to the hall and 12 or more air exchanges per hour, of which at least two exchanges are outside air. For existing structures, six or more air exchanges per hour are acceptable.³⁰

The decisions to initiate and discontinue isolation should be made in consultation with the infection control professional (infection preventionist), the physician, and the local health department. If needed, the Michigan TB Control program is available for consultation at (517) 335-8165. Isolation decisions should be made on a case-by-case basis.

When to Initiate Airborne Infection Isolation

Suspected cases of laryngeal or pulmonary TB should be isolated immediately, before AFB sputum smear results are available.

Initiate TB All precautions for any patient who meets the criteria in Table 4.

Table 4: INITIATION OF AIRBORNE INFECTION ISOLATION³¹

Criteria for Initiation of Airborne Infection Isolation		
The patient has signs or symptoms of pulmonary, laryngeal, or multidrug-resistant tuberculosis (MDR-TB) disease.	OR	<ul style="list-style-type: none">▪ The patient has documented infectious pulmonary, laryngeal tuberculosis (TB) disease or MDR-TB disease. <p style="text-align: center;">AND</p> <ul style="list-style-type: none">▪ The patient has not completed treatment.

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):16, 44.



Patients with suspected or confirmed MDR-TB should remain in an All room throughout their hospitalization or until culture conversion is documented, regardless of sputum smear results.

When to Discontinue Airborne Infection Isolation



Prior to discontinuing isolation, the infection control professional (infection preventionist), the physician, and the local health department should be consulted. If needed, the Michigan TB Control program is available for consultation at (517) 335-8165. High-risk patients should be carefully evaluated before discontinuing isolation. Hospitalized patients with suspected or confirmed MDR-TB should remain in an All room throughout their hospitalization.

Suspected Tuberculosis Disease

For patients placed in All due to suspected infectious TB disease of the lungs, airway, or larynx, All can be discontinued when the criteria in Table 5 are met.

Table 5: DISCONTINUATION OF AIRBORNE INFECTION ISOLATION OF PATIENTS WITH SUSPECTED TUBERCULOSIS³²

Criteria for Discontinuing Airborne Infection Isolation: Suspected Case of Tuberculosis of the Lungs, Airway, or Larynx		
Infectious tuberculosis (TB) disease is considered unlikely.	AND	<p>Either</p> <ul style="list-style-type: none"> ▪ Another diagnosis is made that explains the clinical syndrome. <p>OR</p> <ul style="list-style-type: none"> ▪ The patient has 3 negative acid-fast bacilli (AFB) sputum smear results,* has been on treatment delivered as directly observed therapy, and has demonstrated clinical improvement.
<p>* Each of the 3 sputum specimens should be collected 8 to 24 hours apart, and at least 1 should be an early morning specimen (because respiratory secretions pool overnight). Generally, this will allow patients with negative AFB sputum smear results to be released from All in 2 days.³³</p>		
	<p>While in the hospital for any reason, patients with pulmonary TB should remain in airborne infection isolation until they (1) are receiving standard multidrug antituberculosis therapy; (2) have demonstrated clinical improvement; and (3) have had 3 consecutive AFB-negative smear results of sputum specimens collected 8 to 24 hours apart, with at least 1 being an early morning specimen.³⁴</p>	
	<p>Because patients with TB disease who have negative AFB sputum smear results can still be infectious, patients with suspected disease who meet the above criteria for release from All should not be released to an area where other patients with immunocompromising conditions or children <5 years are housed.³⁵</p>	

Sources: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):16, 43; ATS, CDC. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.

Confirmed Tuberculosis Disease

A patient with drug-susceptible TB of the lung, airway, or larynx who is on standard multidrug antituberculosis treatment and who has had a significant clinical and bacteriologic response to therapy (e.g., reduction in cough, resolution of fever, and progressively decreasing quantities of AFB on smear results) is probably no longer infectious. However, because culture and drug susceptibility results are not usually known when the decision to discontinue All is made, all patients with confirmed TB disease should remain in All while hospitalized until all the criteria in Table 6 are met.³⁶

Table 6: DISCONTINUATION OF AIRBORNE INFECTION ISOLATION OF PATIENTS WITH CONFIRMED TUBERCULOSIS³⁷

Criteria for Discontinuing Airborne Infection Isolation: Hospitalized Patients with Confirmed, Drug-Susceptible Tuberculosis of the Lungs, Airway, or Larynx

- The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 8 to 24 hours apart, with at least 1 being an early morning specimen.
AND
- The patient has received at least 14 days of standard multidrug antituberculosis treatment by directly observed therapy (DOT).
AND
- The patient has demonstrated clinical improvement.

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):43.

Hospital Discharge

The decisions to discharge an acid-fast bacilli (AFB) sputum smear-positive patient or an multidrug-resistant tuberculosis (MDR-TB) patient should be made in consultation with the infection control professional (infection preventionist), the physician, and the local health department. If needed, the Michigan TB Control program is available for consultation at (517) 335-8165.

Drug-Susceptible Tuberculosis Disease

If a hospitalized patient who has suspected or confirmed drug-susceptible TB disease is deemed medically stable (including patients with positive AFB sputum smear results indicating pulmonary TB disease), the patient may be discharged from the hospital before converting AFB sputum smear results to negative if all the criteria in Table 7 are met.³⁸

Table 7: HOSPITAL DISCHARGE OF PATIENTS WITH DRUG-SUSCEPTIBLE TUBERCULOSIS³⁹

Criteria for Hospital Discharge to Home: Patients with Suspected or Confirmed Drug-Susceptible Tuberculosis

- A specific plan exists for follow-up care with the local tuberculosis (TB) control program.
AND
- The patient has been started on a standard multidrug antituberculosis treatment regimen and directly observed therapy (DOT) has been arranged.
AND
- No children aged <5 years or persons with immunocompromising conditions are present in the household.
AND
- All immunocompetent household members have been previously exposed to the patient.
AND
- The patient is willing to remain inside the home except for healthcare-associated visits until the patient has negative acid-fast bacilli (AFB) sputum smear results.

Source: CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):43–44.

Multidrug-Resistant Tuberculosis Disease

Patients with suspected or confirmed MDR-TB disease should remain in the hospital in All until all criteria in Table 8 are met.

Table 8: HOSPITAL DISCHARGE OF PATIENTS WITH MULTIDRUG-RESISTANT TUBERCULOSIS

Criteria for Hospital Discharge to Home: Patients with Suspected or Confirmed Multidrug-Resistant Tuberculosis

- The local health department has evaluated the patient and approved of a discharge plan and venue.
- The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 8 to 24 hours apart, with at least 1 being an early morning specimen.
 AND
- An appropriate treatment regimen has been devised and initiated.
 AND
- Suitable arrangements have been made so that the regimen can be continued and properly monitored on an outpatient basis, specifically by directly observed therapy (DOT).

Release Settings

Patients with suspected or confirmed infectious TB disease should not be released to healthcare settings or homes where the patient can expose others who are at high risk for progressing to TB disease if infected, such as HIV-infected persons or young children.⁴⁰ Hospitalized patients returning to a congregate setting (e.g., a homeless shelter or detention facility) should have three consecutive AFB-negative smear results of sputum specimens collected more than eight hours apart, with at least one being an early morning specimen, before being considered noninfectious.⁴¹

Patients who have positive AFB sputum smear results should **not** be directly discharged from the hospital to **any** of the following living environments:

- Congregate living site (e.g., shelter, nursing home, jail, prison, group home, another hospital)
- Living situation where infants and young children also reside
- Living situation where immunosuppressed persons (e.g., HIV-infected persons or those taking cancer chemotherapy) also reside
- Living situation where home health aides or other social service providers will be present in the home for several hours a day to care for the person or family member

Residential Settings

Patients suspected of having infectious tuberculosis (TB) either are diagnosed during an outpatient workup, or, if admitted to a hospital, are often sent home after starting treatment, even though they may still be infectious. Because patients are most likely to transmit TB to household members **before** TB has been diagnosed and treatment has rendered the patient noninfectious, it is important that TB patients and members of their households know what steps to take to prevent the spread of TB in the home until the patient becomes noninfectious.^{42,43}

Administrative Controls in the Patient's Home

Establish a policy and procedure for managing infectious patients at home. To standardize care, the following information should be included:

- 1. Definition of key terms:** Infectious case and noninfectious case
- 2. Treatment of cases at home whenever possible:** Treat patients at home if their condition does not otherwise require hospitalization.
- 3. Window period treatment policy:** Ensure that candidates for window period treatment in the home have completed their evaluation and are on medication before they are discharged home (or as soon as possible if they were not hospitalized).
- 4. Education:** Educate infectious patients, family, care providers, and close contacts regarding the purpose of isolation, their responsibility to adhere to the isolation requirements, and the consequences of not voluntarily complying with isolation.
- 5. Home isolation agreements:** Have infectious patients in isolation sign a home isolation agreement. This document should include any legal consequences should they fail to voluntarily comply.

Environmental Controls in the Patient's Home

Generally, there are no special engineering recommendations. However, patients and their families can be advised to do the following:

- Have tissues available for patients to cover their mouths and noses when coughing or sneezing.
- Keep windows and doors open (weather permitting) to increase the ventilation and dilution of infectious droplet nuclei in the house.
- If a sputum sample needs to be collected at home, do so in a well-ventilated area away from other residents (e.g., bathroom with an exhaust fan). If possible, collect the sputum in an outdoor area away from open windows or doors.

Respiratory Protection in the Patient's Home

Patient: Mask

- Patients do not need to wear masks at home.
- Give patients regular surgical-type masks and advise them to wear them at medical appointments until they are no longer infectious.



For more information on the criteria for noninfectiousness, see the “Determining Noninfectiousness” topic in this section.

- Do not give patients respirators (N-95 or higher).

Healthcare Worker: Respirator

- Healthcare workers should wear respirators when entering the home or a closed area to visit with infectious patients.
- The respirators should be National Institute for Occupational Safety and Health (NIOSH)-approved (N-95 or higher).
- Healthcare workers should be provided with respirators after appropriate education and testing.

Other Residential Settings

Motels

Homeless persons with infectious TB may be housed in a motel that has outside access to rooms (not via hallways).

The motel manager must be advised of the following:

1. The patient is in respiratory isolation.
2. The manager should report to local public health agency staff if the manager becomes aware that the patient does not stay in the room or if the patient has guests.
3. The manager should advise motel staff that they are not to enter the room while the patient resides at the motel. (Arrangements should be made for weekly linen replacement in which the patient sets out linens that need to be replaced, and the staff knock on the door and leave the linens for the patient to make his or her own bed.)
4. Upon release from isolation, the room should be aired out for one day before staff enter to clean. Afterwards, routine cleaning done between guests is sufficient. There are no additional special cleaning requirements.
5. Local public health agency staff will be delivering medication to the patient (specify the frequency).
6. Arrangements have been made for food delivery to the patient.

Healthcare Facilities or Residential Settings

1. Patients with infectious TB should be in appropriate respiratory isolation (airborne infection isolation rooms) when housed in healthcare facilities or residential settings.
2. If a facility does not have the capability to provide appropriate respiratory isolation, the patient should be transferred to a facility that can accommodate respiratory isolation until the patient is noninfectious. Once noninfectious, the person may return to the original facility.

Return to Work, School, or Other Social Settings

The decision of when to allow a patient to return to work, school, or other social settings should be made in consultation with your local health department. The Michigan TB Control Program at (517) 335-8165 is also available for consultation.

The decision to permit a patient to return to work, school, or other social settings is based on the following:

- The characteristics of the patient with TB disease (e.g., whether the patient is likely to adhere to the regimen and follow treatment instructions)
- The characteristics of the TB disease itself (e.g., multidrug-resistant versus drug-susceptible TB, AFB sputum smear-positive versus smear-negative, cavitory versus noncavitory)
- The duration of current treatment (For example, the patient has received standard multidrug antituberculosis therapy for two-to-three weeks. However, for patients with sputum AFB smear results that are negative or rarely positive, the threshold for treatment is five-to-seven days.)⁴⁴
- The environment(s) to which the patient will be returning



Prior to notifying a patient that he or she is able to return to work or school, please consult with your local health department's TB control program. If needed, the Michigan TB Control Program at (517) 335-8165 is also available for consultation.

Drug-Susceptible Tuberculosis Disease

Patients with drug-susceptible TB are no longer considered infectious if they meet all the criteria in Table 9.

Table 9: RETURN TO WORK, SCHOOL, AND OTHER SETTINGS OF PATIENTS WITH DRUG-SUSCEPTIBLE TUBERCULOSIS⁴⁵

Criteria for Return to Work, School, or Other Social Settings: Patients with Suspected or Confirmed Drug-Susceptible Tuberculosis

- The patient is on adequate therapy.
AND
- The patient has had a significant clinical response to therapy.
AND
- The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 8 to 24 hours apart, with at least 1 being an early morning specimen.

Multidrug-Resistant Tuberculosis Disease

Regardless of their occupation, patients known or likely to have pulmonary MDR-TB may be considered for return to work or school only if they meet all four of the criteria in Table 10.

Table 10: RETURN TO WORK, SCHOOL, AND OTHER SETTINGS OF PATIENTS WITH MULTIDRUG-RESISTANT TUBERCULOSIS

Criteria for Return to Work, School, or Other Social Settings: Patients with Suspected or Confirmed Multidrug-Resistant Tuberculosis

- The resolution of fever and the resolution, or near resolution, of cough has occurred.
 AND
- The patient is on current treatment via DOT with an antituberculosis regimen to which the strain is known or likely to be susceptible.*
 AND
- The patient has had 3 consecutive negative acid-fast bacilli (AFB) sputum smear results collected 8 to 24 hours apart, with at least 1 being an early morning specimen.
 AND
- The patient has had a negative culture for *Mycobacterium tuberculosis*.

Tuberculosis Infection Control in Patient Care Facilities

Patients with suspected tuberculosis (TB) may present for care in many different settings. The Centers for Disease Control and Prevention (CDC) has written a comprehensive set of guidelines for TB infection control in acute care hospitals and other medical settings.⁴⁶ In addition to the CDC guidelines, various professional organizations or state regulations may have guidelines for managing TB patients.

The main focus in establishing a TB infection control program at a patient care facility is to do the following:

1. Assign responsibility for managing the program to a designated staff position.
2. Perform and establish a TB risk assessment for the facility.
3. Develop the TB infection control plan based on the level of TB risk identified in the assessment.

The main purpose for having an effective TB infection control plan in a facility is to assure that the activities necessary for TB control are addressed and that policies and procedures are developed to protect the healthcare workers, other patients, and visitors in the facility.

Table 11: **Guidelines for Tuberculosis Infection Control** lists references that provide the information needed to conduct a TB risk assessment and write a TB infection control plan to establish policies and procedures for TB control activities for inpatient care facilities.



Call your local health department's TB control program or the Michigan TB Control Manager at (517) 335-8165 if you have any questions when consulting with institutions on infection control measures.

Table 11: GUIDELINES FOR TUBERCULOSIS INFECTION CONTROL

Guidelines for Tuberculosis Infection Control

The following settings are addressed in the "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Facilities, 2005" (*MMWR* 2005;54[No. RR-17]) at this hyperlink: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm>. Some settings have additional guidelines as noted below.

Inpatient Settings

- Emergency departments and urgent care settings
- Intensive care units
- Surgical suites
- Laboratories
- Bronchoscopy suites
- Sputum induction and inhalation therapy rooms
- Autopsy suites and embalming rooms

Outpatient Settings

- Tuberculosis (TB) treatment facilities
- Medical settings in correctional facilities: Prevention and Control of Tuberculosis in Correctional Facilities. (ACET) (*MMWR* 1996;45[No. RR-8]) at this hyperlink: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00042214.htm>
- Medical offices and ambulatory care settings
- Dialysis units

Nontraditional Facility-Based Settings

- Homeless shelter clinics: Prevention and Control of Tuberculosis Among Homeless Persons (ACET) (*MMWR* 1992;41[No. RR-5]) at this hyperlink: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00019922.htm>
- Emergency medical services
- Home-based healthcare and outreach settings
- Long-term care facilities (e.g., hospices, skilled nursing facilities): Prevention and Control of Tuberculosis in Facilities Providing Long-Term Care to the Elderly (*MMWR* 1990;39[No. RR-10]) at this hyperlink: <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001711.htm>

Transportation Vehicles

To prevent the transmission of *Mycobacterium tuberculosis* while transporting patients, follow the respiratory precautions identified below.

Patient Self-Transport

1. The car windows should be opened, and any recirculating air controls should be turned off.
2. If possible, only household members should accompany the patient. Members of the patient's household who accompany the patient do not need to wear surgical masks.
3. If the only source for transport is a friend or relative who is not a member of the patient's household:
 - a. The person accompanying the patient should be given a respirator (N-95) to wear during transport (due to the confined space and risk of ongoing exposure).
 - b. The patient should sit in the back seat and wear a surgical mask.
 - c. The car windows should be opened, and any recirculating air controls should be turned off.
4. The patient should wear a surgical mask after leaving the vehicle.⁴⁷

Transport by Healthcare Workers

1. Healthcare workers should wear respiratory protection (N-95) while in the vehicle.
2. The patient should wear a surgical mask and sit in the back seat.
3. The car windows should be opened, and any recirculating air controls should be turned off.⁴⁸

Transport by Emergency Medical Services

Emergency medical services staff may have specialized vehicles that have the ability to separate the driver's compartment from the transport compartment and/or may be equipped with rear exhaust fans. Recommendations for these vehicles and staff are addressed in the Centers for Disease Control and Prevention (CDC) "Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005" (*MMWR* 2005;54[No. RR-17]:25–26, 88, 127) at this hyperlink:

<http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .

Resources and References

Resources

- CDC. “Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005” (*MMWR* 2005;54[No. RR-17]). Available at: <http://www.cdc.gov/mmwr/pdf/rr/rr5417.pdf> .
- CDC. “Guidelines for Environmental Infection Control in Health-care Facilities” (*MMWR* 2003;52[No. RR-10]). Available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5210.pdf> .
- CDC. “Infection Control in Health-Care Settings” (*TB Elimination Fact Sheet* April 2006). Available at: <http://www.cdc.gov/tb/publications/factsheets/prevention/ichcs.htm> .
- CDC. *Interactive Core Curriculum on Tuberculosis*. Available at: <http://www.cdc.gov/tb/webcourses/corecurr/index.htm> .
- CDC. “Respiratory Protection in Health-Care Settings” (*TB Elimination Fact Sheet* April 2006). Available at: <http://www.cdc.gov/tb/publications/factsheets/prevention/rphcs.htm>
- CDC. Module 4: “Treatment of TB Infection and Disease” (*Self-Study Modules on Tuberculosis 1999*). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm.
- CDC. Module 5: “Infectiousness and Infection Control” (*Self-Study Modules on Tuberculosis 1999*). Available at: http://www.cdc.gov/tb/education/ssmodules/Cont_Ed_regist.htm .
- NIOSH. “Respiratory Protection” [Web page]. Available at: <http://www.cdc.gov/niosh/npptl/topics/respirators/> .
- OSHA. “Tuberculosis: OSHA Standards” [Web page]. Available at: <http://www.osha.gov/SLTC/tuberculosis/standards.html> .

References

-
- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):15.
 - ² CDC. Module 5: infectiousness and infection control. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:5. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
 - ³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):1–2.
 - ⁴ CDC. Prevention and control of tuberculosis in facilities providing long-term care to the elderly. *MMWR* 1990;39(No. RR-10).
 - ⁵ CDC. Prevention and Control of tuberculosis in U.S. communities with at-risk minority populations and prevention and control of tuberculosis among homeless: recommendations of the Advisory Council for the Elimination of Tuberculosis. *MMWR* 1992;41(No. RR-5).
 - ⁶ CDC. Prevention and control of tuberculosis in correctional facilities. (ACET) *MMWR* 1996;45(No. RR-8).

-
- ⁷ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. *MMWR* 2005;54(No. RR-17):7.
- ⁸ CDC. Essential components of a tuberculosis prevention and control program: screening for tuberculosis and tuberculosis infection in high-risk populations. *MMWR* 1995;44(No. RR-11):3.
- ⁹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):8.
- ¹⁰ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):7.
- ¹¹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):8.
- ¹² CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):9.
- ¹³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):8.
- ¹⁴ CDC. Module 1: transmission and pathogenesis. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:3. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ¹⁵ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):7.
- ¹⁶ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):75.
- ¹⁷ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):77.
- ¹⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):78.
- ¹⁹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):39.
- ²⁰ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):39.
- ²¹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):39.
- ²² CDC. Respiratory protection in health-care settings. *TB Elimination Fact Sheet*. April 2006.
- ²³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):38–40.
- ²⁴ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):28.
- ²⁵ CDC. Public Health Measures in Response to SARS: Isolation, Quarantine, and Community Control. *Severe Acute Respiratory Syndrome Fact Sheet*. September 11, 2003:1.
- ²⁶ CDC. Public Health Measures in Response to SARS: Isolation, Quarantine, and Community Control. *Severe Acute Respiratory Syndrome Fact Sheet*. September 11, 2003:1.
- ²⁷ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43.
- ²⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43.
- ²⁹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.
- ³⁰ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):37.
- ³¹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):16, 44.
- ³² CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):16, 43.
- ³³ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):16, 43.
- ³⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.
- ³⁵ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43–44.
- ³⁶ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43.
- ³⁷ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43.

-
- ³⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43.
- ³⁹ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):43–44.
- ⁴⁰ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):44.
- ⁴¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.
- ⁴² CDC. Module 5: infectiousness and infection control. *Self-Study Modules on Tuberculosis* [Division of Tuberculosis Elimination Web site]. 1999:8. Available at: <http://www.cdc.gov/tb/pubs/ssmodules/default.htm> . Accessed July 3, 2006.
- ⁴³ National Tuberculosis Controllers Association-National Tuberculosis Nurse Consultant Coalition. *Tuberculosis Nursing: A Comprehensive Guide to Patient Care*. Atlanta, GA: 1997:103–116.
- ⁴⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):9.
- ⁴⁵ CDC. Infectiousness; in Chapter 8: Infection control. *Core Curriculum on Tuberculosis 2000*.
- ⁴⁶ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):1–140.
- ⁴⁷ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):18, 26.
- ⁴⁸ CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care facilities, 2005. *MMWR* 2005;54(No. RR-17):18, 26.

Interjurisdictional Notifications

CONTENTS

Introduction.....	13.2
Purpose.....	13.2
Policy	13.3
When to Initiate a Notification	13.4
How to Issue a Notification.....	13.5
Transfers inside the United States.....	13.5
Sample Interjurisdictional TB Notification and Follow-Up Forms.....	13.6
Transfers outside the United States.....	13.8
References	13.10

Introduction

Purpose

Use this section to do the following:

- Notify public health agency staff in another jurisdiction that a person is moving (or has moved) to their jurisdiction who is any of the following:
 - Verified or suspected case of tuberculosis (TB) disease
 - High-priority contact to a smear-positive Class 3 or Class 5 pulmonary case, contact to a smear-negative Class 3 pulmonary case, or contact to a highly suspect Class 5 pulmonary case
 - Documented convertor who has initiated treatment for latent tuberculosis infection (LTBI)
 - Class 2 or Class 4 patient who has initiated treatment for LTBI
 - Close associate to a Class 3 index case with clinical presentation consistent with recently acquired disease in a source-case investigation or close associate to a child with LTBI in a source-case investigation
- Follow up on notifications.
- Enroll mobile TB patients in the TBNet tracking and referral service.



For a definition of tuberculosis (TB) patient classifications, see the “Tuberculosis Classification System” topic in the Surveillance section.

Making sure that TB patients complete their evaluation and treatment is a critical element of TB control.¹ Some patients receiving treatment for TB disease in the United States move from one jurisdiction to another before completing treatment. Notifying the receiving local and/or state jurisdiction of a patient’s impending arrival will prevent care from being interrupted and improve treatment outcome.

The term *Interjurisdictional notification* refers to a referral and/or follow-up report. Before the patient moves, or as soon as it becomes apparent that a patient has moved, the referring jurisdiction provides a referral to the receiving jurisdiction. After the patient has moved, the receiving jurisdiction then provides the referring jurisdiction with a follow-up report.

Policy

The MDCH TB Control Program is responsible for coordination of transfer notifications between states and local health departments within the state. The referring local health department should notify the MDCH TB Control Program when a patient plans or requests to transfer to another jurisdiction. The receiving and referring jurisdictions should stay in communication until final dispensation of the patient is known.



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

When to Initiate a Notification

In general, Interjurisdictional notification should be made for any of the following circumstances or types of patients. Please contact the MDCH TB Control Program with any questions about when or how to initiate an Interjurisdictional notification.

Table 1: TRANSFER NOTIFICATIONS AND FOLLOW-UPS²

Referral Type	When to Initiate	Notes
Verified and suspected cases of tuberculosis (TB) disease	When notified that a Class 3 or 5 patient is moving or has moved from the area for 30 days or more	May also initiate to coordinate directly observed therapy (DOT) while patient is visiting another area.
Contacts	After identifying a: <ul style="list-style-type: none"> ▪ High-priority contact to a smear-positive Class 3 or Class 5 pulmonary case ▪ Contact to a smear-negative Class 3 pulmonary case ▪ Contact to a highly suspect Class 5 pulmonary case 	Send individual referrals for each contact.
Latent TB Infection (LTBI) converters	When notified that a documented convertor who has initiated treatment is moving or has moved from the area for 30 days or more	
LTBI reactors	When notified that a Class 2 or 4 patient who has initiated treatment is moving or has moved from the area for 30 days or more	
Source case investigation for TB disease	After identifying a close associate to a Class 3 index case with clinical presentation consistent with recently acquired disease	Use primarily for associates to children under 5 years of age with TB disease. A younger age cut-off may be advisable because the focus would be on more recent transmission. ³
Source case investigation for LTBI	After identifying a close associate to a child with LTBI	Use primarily for associates to children under 2 years of age with LTBI. ⁴
Final disposition	When final status and/or outcome is known	

Source: NTCA. *Interjurisdictional Tuberculosis (TB) Notification—National Tuberculosis Controllers Association Recommendations*. Smyrna, GA: March 2002:1–5.

How to Issue a Notification

Inside the United States (within the state or between states), see Table 2: **Referrals in the United States**.

Outside the United States, contact the MDCH TB Control Program. The MDCH TB Control Program will work with the receiving country to report the case.

Transfers Inside the United States

An Interjurisdictional tuberculosis (TB) notification system has been set up by the National Tuberculosis Controllers Association (NTCA) to facilitate and standardize communication between states. This system will enhance continuity and completeness of care and improve outcome evaluation of verified cases.⁵ Interjurisdictional notification and Follow-Up forms are available online at the MDCH TB Control Program website: <http://www.michigan.gov/tb>. Table 2: **Referrals in the United States** provides an overview of the Interjurisdictional notification process, and the roles of the referring local health department and the MDCH TB Control Program. The referring local health department should make a referral as soon as possible when a patient has moved or is going to move, or when a contact to a Michigan case has been identified in another jurisdiction.

Table 2: REFERRALS IN THE UNITED STATES⁶

Steps	Local Health Department should
1. Make referral	<ul style="list-style-type: none">• Complete the NTCA “Interjurisdictional TB Notification” form and “Interjurisdictional TB Follow-Up” form (if appropriate)• Fax the forms to the MDCH TB Control Program and retain the original in the patient’s file. The MDCH TB Control Program will forward the forms to the receiving jurisdiction and keep a copy• Copy the complete and updated local health department file on the patient and mail to the jurisdiction receiving the patient• Call the patient’s private provider (if they have one) and arrange for transfer of the patient’s records to the receiving private provider, or to the receiving jurisdiction if a new private provider has not been identified.
2. Provide records to the patient	The local health department from which the patient is transferring should provide the patient a copy of the referral and treatment records.
3. Follow up on referral	The receiving jurisdiction or provider is responsible for completing and returning the Follow-Up form in a timely manner. If you do not receive timely follow-up on a patient you referred, you may contact the receiving jurisdiction directly, or the MDCH TB Control Program for assistance in obtaining follow-up information.

Source: NTCA. *Interjurisdictional Tuberculosis (TB) Notification—National Tuberculosis Controllers Association Recommendations*. Smyrna, GA: March 2002:1–5.

Transfers Outside the United States

The local health department should notify the MDCH TB Control Program as soon as they are aware that a patient plans to leave or has left the country. Two options are currently in use by the MDCH TB Control Program for international notifications: notification via CDC-establish protocol and contacts; and notification via Migrant Clinician Network's TBNet.

Centers for Disease Control and Prevention International Notifications

The notification process for international TB cases developed by the CDC is briefly described on the "Process for International Notification of TB Cases" Web page at <http://www.cdc.gov/tb/programs/international/default.htm>.

The MDCH TB Control Program will send international referrals directly to the destination country as soon as possible after receiving information about the patient's move, or when a contact/associate is identified in another country.

To make an international referral through CDC, the MDCH TB Control Program will:

1. Complete the International Tuberculosis Notification Form.
2. Forward a copy of the notification by express mail or fax to the destination country's TB control program or designated official.
3. Provide the referring local health department with a copy of the referral. If possible, the local health department should provide the patient with a copy of their treatment records prior to their departure. This should include any medication given and the dosing and regimen used or prescribed by the referring health department.

Migrant Clinician Network & TBNet: International and Domestic Transfers in Mobile, Underserved Populations

TBNet (<http://www.migrantclinician.org/services/tbnet>) is a multinational TB patient tracking and referral project for mobile, underserved populations. Although the program was originally created for migrant farm workers, it is expanding to include any patient who might be mobile during their treatment, such as the homeless, immigration detainees, or prison parolees. The MDCH TB Control Program will facilitate referral of a patient through TBNet.

TBNet offers the following services:

- **Portable, wallet-sized treatment records.** TBNet supplies TB clinics with records that summarize a patient's TB treatment and can easily be carried by the patient.
Toll-free line (1-800-825-8205) for healthcare providers and patients. Healthcare providers from the United States or Mexico can call to request an up-to-date copy of medical records of patients enrolled in TBNet. Patients can call for help with locating treatment facilities at their next destination.

To enroll a patient in TBNET:

1. Please contact the MDCH TB Control Program as soon as possible to initiate a TBNET referral once a patient known to be mobile has started treatment, or once you become aware that a patient intends or is likely to move. Contact the MDCH TB Control Program to notify of the need to refer and obtain the necessary forms.
2. Complete the TBNET Consent, Patient Information, and Medical History forms. These are available from the MDCH TB Control Program or online at: <http://www.migrantclinician.org/services/health-network-forms.html>.
3. Fax the forms, copies of any chest radiograph interpretations and all laboratory reports, to the MDCH TB Control Program.
4. Provide the patient with the portable, wallet-sized treatment record and TBNET's toll free number (1-800-825-8205).

References

- ¹ CDC. International notification of tuberculosis cases [Division of Tuberculosis Elimination Web site]. Available at: <http://www.cdc.gov/tb/programs/international/default.htm>.
- ² NTCA. *Interjurisdictional Resources* [NTCA Web site]. Available at: <http://tbcontrollers.org/?p=9>.
- ³ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC. *MMWR* 2005;54(No. RR-15), available at: <http://www.cdc.gov/tb/publications/guidelines/ContactInvestigations.htm>; and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15), available at: <http://www.cdc.gov/tb/publications/guidelines/Testing.htm>.
- ⁴ CDC, NTCA. Guidelines for the investigation of contacts of persons with infectious tuberculosis; recommendations from the National Tuberculosis Controllers Association and CDC, and guidelines for using the QuantiFERON[®]-TB Gold test for detecting *Mycobacterium tuberculosis* infection, United States. *MMWR* 2005;54(No. RR-15):31.
- ⁵ NTCA. *Interjurisdictional Resources* [NTCA Web site]. Available at: <http://tbcontrollers.org/?p=9>.

B Notifications

CONTENTS

Introduction.....	14.2
Purpose.....	14.2
Pre-arrival medical screening for tuberculosis.....	14.2
Policy.....	14.5
Follow-up of B1 and B2 Tuberculosis Arrivals.....	14.6
Division of Global Migration and Quarantine forms and Overview of Notification Process for Newly-Arrived Individuals.....	14.6
Patient follow-up.....	14.7
The TB Follow-Up Worksheet.....	14.8
Completion of the TB Follow-Up Worksheet.....	14.10
Evaluation of B1 and B2 Tuberculosis Arrivals.....	14.14
Evaluation activities.....	14.14
Treatment.....	14.14
Resources and References.....	14.16

Introduction

Purpose

Use this section to do the following:

- Follow up on B notifications.
- Evaluate and treat immigrants with B notifications.

B notifications are sent by the Centers for Disease Control and Prevention (CDC) to the MDCH TB Control Program as follow-up to the screening mandated by United States immigration law. The purpose of mandated screening is to deny entry to persons who have either communicable diseases of public health import or physical or mental disorders associated with harmful behavior, abuse drugs or are addicted to drugs, or are likely to become wards of the state.¹

This notification system follows up on medical screenings of persons with TB classifications after their arrival in the United States.^{2,3} Immigrants with TB classifications are identified at ports of entry to the United States by the United States Citizenship and Immigration Services (USCIS) on entry to the United States and are reported to CDC's Division of Global Migration and Quarantine (DGMQ). The DGMQ notifies state and local health departments of refugees and immigrants with TB classifications who are moving to their jurisdictions.

Recommendations for local follow-up and evaluation of Class B arrivals are frequently revised by DGMQ. Updated guidelines will be provided as they become available.

Pre-Arrival Medical Screening for Tuberculosis

Not all foreign-born persons who enter the United States go through the same official channels or through the screening process.⁴ For a summary of which groups of foreign-born persons are screened, refer to Table 1: **Numbers of Foreign-Born Persons Who Entered the United States, by Immigration Category, 2002**. Persons entering in the nonimmigrant category do not require pre-entry screening, but as a condition of entry, persons migrating as immigrants, refugees, and asylees are required to be screened outside the United States for diseases of public health significance, including TB.^{5,6}

Table 1: NUMBERS OF FOREIGN-BORN PERSONS WHO ENTERED THE UNITED STATES, BY IMMIGRATION CATEGORY, 2002^{7,8}

Category	Number	Percentage of Total	Screening Required?
Immigrants are defined by the Office of Immigration Statistics (OIS) as persons legally admitted to the United States as permanent residents.	384,000	1.38%	Yes
Refugees and asylees , as defined by OIS, are persons admitted to the United States because they are unable or unwilling to return to their country of nationality due to persecution or a well-founded fear of persecution. Refugees apply for admission at an overseas facility and enter the United States only after their application is granted; asylees apply for admission when already in the United States or at a point of entry.	132,000	0.46%	Yes
Nonimmigrants are aliens granted temporary entry to the United States for a specific purpose (the most common visa classifications for nonimmigrants are visitors for pleasure, visitors for business, temporary workers, and students).	27,907,000	98.18%	No
The foreign-born population , as defined by the Census Bureau, refers to all residents of the United States who were not US citizens at birth, regardless of their current legal or citizenship status.	28,423,000	100%	See above
Unauthorized immigrants (also referred to as illegal or undocumented immigrants) are foreign citizens illegally residing in the United States. They include both those who entered without inspection and those who violated the terms of a temporary admission without having gained either permanent resident status or temporary protection from removal. ⁹			

Sources: Congress of the United States, Congressional Budget Office. *A Description of the Immigrant Population*. Washington, DC: Congressional Budget Office; November 2004; and ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.

Applicants for immigration who plan to relocate permanently to the United States are required to have a medical evaluation prior to entering the country. The technical instructions (TI), or requirements, for the TB-related components of these medical evaluations differ depending upon the country of most recent origin, population group, and date of screening. Two different sets of TI have been developed by DGMQ and both are in use: 1991 TI and 2007 TI.

Most applicants for US immigration are being screened according to the *1991 Technical Instructions for Panel Physicians*. These instructions are available at this hyperlink: http://www.cdc.gov/ncidod/dg/panel_1991.htm. In 2007, new technical instructions for TB medical evaluation were approved and are in the process of being phased into use. These instructions are available at this hyperlink: http://www.cdc.gov/ncidod/dg/pdf/ti_tb_8_9_2007.pdf. To identify which countries have implemented screening according to the 2007 TI, reference http://www.cdc.gov/ncidod/dg/panel_2007.htm. Any country not screening according to the 2007 TI is following the 1991 TI. Table 2 highlights tuberculosis evaluation classifications for the 1991 and 2007 TI. For a detailed comparison of the evaluation and interpretations under the 1991 and 2007 TI, please refer to http://www.cdc.gov/ncidod/dg/pdf/comparison_1991_2007_tb_ti.pdf.

Table 2: COMPARISON OF 1991 AND 2007 TUBERCULOSIS CLASSIFICATIONS

Category	1991	2007
No TB Classification	Applicants with normal tuberculosis screening examinations	Applicants with normal tuberculosis screening examinations
Class A	"Tuberculosis, infectious." Abnormal CXR and one or more positive sputum smears.	Applicants who have tuberculosis disease diagnosed (sputum smear positive or culture positive) and require treatment overseas but who have been granted a waiver to travel prior to the completion of therapy.
Class B1 - Pulmonary	"Tuberculosis clinically active, not infectious." Abnormal CXR and sputum smears negative	No treatment: Applicants who have medical history, physical exam, or CXR findings suggestive of pulmonary tuberculosis but have negative AFB sputum smears and cultures and are not diagnosed with tuberculosis or can wait to have tuberculosis treatment started after immigration. Completed treatment: Applicants who were diagnosed with pulmonary tuberculosis and successfully completed directly observed therapy prior to immigration
Class B1- Extrapulmonary	"Extrapulmonary tuberculosis, clinically active, not infectious." Radiographic or other evidence of extrapulmonary tuberculosis, clinically active	Evidence of extrapulmonary tuberculosis
Class B2	"Tuberculosis, not clinically active." Abnormal CXR suggestive of tuberculosis, not clinically active. No sputum smears required.	LTBI Evaluation. Applicants who have a tuberculin skin test ≥ 10 mm (among applicants ≤ 5 years of age) but who otherwise have a negative evaluation for tuberculosis.
Class B3	"Consistent with tuberculosis, old or healed." Abnormal CXR; only abnormality is calcified hilar lymph node, primary complex, or granuloma. No sputum smears required.	Contact Evaluation. Applicants who are a contact of a known tuberculosis case.

Source: Centers for Disease Control and Prevention (CDC). 2007 Technical Instructions for Tuberculosis Screening and Treatment. Available at http://www.cdc.gov/ncidod/dg/panel_2007.htm.

Policy

The CDC and the Advisory Council for the Elimination of Tuberculosis (ACET) recommend screening high-risk populations for TB, including recent arrivals from areas of the world with a high prevalence of TB. On the basis of its very high success rate of detecting TB cases, domestic follow-up evaluation of immigrants and refugees with Class B1 and B2 TB notification status should be given highest priority by all TB control programs.¹⁰

Newly-arrived refugees and immigrants with Class B TB should receive thorough and timely TB evaluations and appropriate treatment to ensure prompt detection of TB disease and prevention of future cases.¹¹



For roles and responsibilities, refer to the “Roles, Responsibilities, and Contact Information” topic in the Introduction.

Follow-up of B1 and B2 Tuberculosis Arrivals

Division of Global Migration and Quarantine Forms and Overview of Notification Process for Newly-Arrived Individuals

The Centers for Disease Control and Prevention (CDC) Division of Global Migration and Quarantine (DGMQ) generates the following Class B notification forms:

- DS-2053: “Medical Examination for Immigrant or Refugee Application”
- DS-3024: “Chest X-Ray and Classification Worksheet”
- DS-3025: “Vaccination Documentation Worksheet”
- DS-3026: “Medical History and Physical Examination Worksheet”
- TB Follow-Up Worksheet (No DS number, included for class A or B only)

Upon arrival at a U.S. port of entry, medical information and files from the immigrant’s or refugee’s overseas examination are entered into a secure CDC database known as the Electronic Disease Notification (EDN) system. The DGMQ notifies the MDCH TB Control Program of newly-arrived immigrants and refugees in Michigan via e-mail. Upon notification of new arrivals in Michigan, the MDCH TB Control Program accesses the EDN database and downloads and prints all available information for the newly-arrived immigrants or refugees. This information is then mailed to the appropriate local health departments for their information and follow-up, if required. Unless a local health department requests otherwise, the MDCH TB Control Program will forward all files for newly-arrived immigrants and refugees, regardless of their disease classification status. This is done to assure that local health departments are aware of all new arrivals in their jurisdiction and does not imply that follow-up is required for individuals without a disease classification. If your health department wishes not to receive notification of individuals with no disease classification, please contact the MDCH TB Control Program.

The DGMQ also sends a letter to any immigrant or refugee with a tuberculosis (TB) condition, indicating that a follow-up is needed in the United States.¹²

Patient Follow-up



The immigration paperwork may make it appear that a patient has had a complete evaluation for TB disease. However, the overseas evaluation is designed only to detect abnormal radiographs and determine infectiousness at the time of travel and does not rule out disease. All B1 and B2 arrivals need a new diagnostic evaluation for active disease, including a tuberculin skin test and new chest radiograph. Even if active TB disease is ruled out, most B1 and B2 arrivals are priority candidates for treatment of latent TB infection.

Follow-up on each B1 and B2 arrival as described below.

1. Check to see if the immigrant has already visited the health department or a private provider.
2. If not, make a telephone call to the home of the immigrant's sponsor or relative within five business days after receiving the notification. Arrange for the immigrant to come in during clinic hours at the health department and/or arrange for the patient to see a private provider. Whenever possible, communications should be made in the immigrant's first language.
3. If the immigrant does not visit the health department or a private provider within 10 business days (two weeks) of the telephone call, send a registered letter to the home of the immigrant's sponsor or relative. Whenever possible, communications should be made in the immigrant's first language.
4. If the immigrant does not visit the health department or a private provider within 10 business days (two weeks) of the letter, make a visit to the home of the immigrant's sponsor or relative. Take a representative who speaks the immigrant's first language if at all possible (if needed).
5. Every effort should be made to locate B1 or B2 arrivals as these immigrants are considered high risk for TB disease. Call the MDCH TB Control Program for consultation when an immigrant is not located.
6. Complete Class B follow-up within one month.
7. Complete and fax the TB Follow-Up Worksheet to the MDCH TB Control Program.¹³ This form is essential for conducting statewide surveillance, following-up on all B1 and B2 arrivals, and satisfying reporting requirements to the CDC.

The TB Follow-Up Worksheet

TB Follow-Up Worksheet				Version 2.0 10/30/2007	
A. Demographic Information					
A1. Name (Last, First, Middle)		A2. Alien #:	A3. Visa Type:	A4. Initial U.S. Entry Date:	
A5. Age:	A6. Gender:	A7. DOB:	A8. TB Class:	A9. Class Condition:	
A10. Country of Examination:			A11. Country of Birth:		
A12. Data Entry Q-Station:		A13. Officer in Charge:		A14. Q-Station Phone:	
A15c.		A16a. Sponsor Agency Name: A16b. Sponsor Agency Phone: A16c. Sponsor Agency Address:			
B. Jurisdictional Information					
B1. Destination State:		B2. Jurisdiction:		B3. Jurisdiction Phone #:	
C. U.S. Evaluation					
C1. Date of Initial U.S. Medical Evaluation: / /					
C2a. TST Placed:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown		
C2b. TST Placement Date:	/ /			C2e. History of Previous Positive TST <input type="checkbox"/>	
C2c. TST mm:					
C2d. TST Interpretation:	<input type="checkbox"/> Positive	<input type="checkbox"/> Negative	<input type="checkbox"/> Unknown		
C3a. Quantiferon (QFT) Test:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown		
C3b. QFT Collection Date:	/ /				
C3c. QFT Result:	<input type="checkbox"/> Positive	<input type="checkbox"/> Negative	<input type="checkbox"/> Indeterminate	<input type="checkbox"/> Unknown	
U.S. Review of Overseas CXR			Domestic CXR		Comparison
C4. Overseas CXR Available? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Verifiable			C7. U.S. CXR Done? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Verifiable		C11. U.S. CXR Comparison to Overseas CXR: <input type="checkbox"/> Stable <input type="checkbox"/> Worsening <input type="checkbox"/> Improving <input type="checkbox"/> Unknown
C5. U.S. Interpretation of Overseas CXR: <input type="checkbox"/> Normal <input type="checkbox"/> Abnormal <input type="checkbox"/> Poor Quality <input type="checkbox"/> Unknown			C8. Date of U.S. CXR: / /		
C6. Overseas CXR Abnormal Findings: <input type="checkbox"/> Abnormal, not TB <input type="checkbox"/> Cavity <input type="checkbox"/> Fibrosis <input type="checkbox"/> Infiltrate <input type="checkbox"/> Granuloma(ta) <input type="checkbox"/> Adenopathy <input type="checkbox"/> Other (Specify) _____			C9. Interpretation of U.S. CXR: <input type="checkbox"/> Normal <input type="checkbox"/> Abnormal <input type="checkbox"/> Unknown		
C10. U.S. CXR Abnormal Findings: <input type="checkbox"/> Abnormal, not TB <input type="checkbox"/> Cavity <input type="checkbox"/> Fibrosis <input type="checkbox"/> Infiltrate <input type="checkbox"/> Granuloma(ta) <input type="checkbox"/> Adenopathy <input type="checkbox"/> Other (Specify) _____					
C12. U.S. Microscopy / Bacteriology <input type="checkbox"/> Specimen not collected in U.S.					
Spec #	Specimen Source	Date	AFB Smear Result	Culture Result	Drug Resistance (DR)
1	_____	/ /	<input type="checkbox"/> Not Done <input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> NTM <input type="checkbox"/> Negative <input type="checkbox"/> Contaminated <input type="checkbox"/> MTB Complex <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> Mono-RIF <input type="checkbox"/> No DR <input type="checkbox"/> MDR-TB <input type="checkbox"/> Mono-INH <input type="checkbox"/> Other DR
2	_____	/ /	<input type="checkbox"/> Not Done <input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> NTM <input type="checkbox"/> Negative <input type="checkbox"/> Contaminated <input type="checkbox"/> MTB Complex <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> Mono-RIF <input type="checkbox"/> No DR <input type="checkbox"/> MDR-TB <input type="checkbox"/> Mono-INH <input type="checkbox"/> Other DR
3	_____	/ /	<input type="checkbox"/> Not Done <input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> NTM <input type="checkbox"/> Negative <input type="checkbox"/> Contaminated <input type="checkbox"/> MTB Complex <input type="checkbox"/> Unknown	<input type="checkbox"/> Not Done <input type="checkbox"/> Mono-RIF <input type="checkbox"/> No DR <input type="checkbox"/> MDR-TB <input type="checkbox"/> Mono-INH <input type="checkbox"/> Other DR

TB Follow-Up Worksheet (Cont)

Version 2.0 10/30/2007

U.S. Review of Overseas Treatment

<p>C13. Overseas Treatment Recommended by Panel Physician:</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>	<p>C14. US Review of TB Disease Overseas Treatment:</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>If Yes</p> <p><input type="checkbox"/> Patient-Reported</p> <p><input type="checkbox"/> Panel Physician-Documented</p> <p><input type="checkbox"/> Both</p>	<p>C15. Arrived on Treatment:</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>	<p>C16. Completed Treatment Overseas:</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>
---	---	--	--

C17. Overseas Treatment Concerns: Yes No

D. Disposition

D1. Disposition Date: __/__/__

D2. Evaluation Disposition:

<p><input type="checkbox"/> Completed Evaluation</p> <p><input type="checkbox"/> Treatment Recommended</p> <p><input type="checkbox"/> No Treatment Recommended</p>	<p><input type="checkbox"/> Initiated Evaluation / Not Completed</p> <p><input type="checkbox"/> Moved within U.S.</p> <p><input type="checkbox"/> Lost to Follow-up</p> <p><input type="checkbox"/> Returned to Country of Origin</p> <p><input type="checkbox"/> Refused Evaluation</p> <p><input type="checkbox"/> Died</p> <p><input type="checkbox"/> Other, specify _____</p>	<p><input type="checkbox"/> Did Not Initiate Evaluation</p> <p><input type="checkbox"/> Not Located</p> <p><input type="checkbox"/> Moved within U.S.</p> <p><input type="checkbox"/> Lost to Follow-up</p> <p><input type="checkbox"/> Returned to Country of Origin</p> <p><input type="checkbox"/> Refused Evaluation</p> <p><input type="checkbox"/> Died</p> <p><input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Other, specify _____</p>
---	---	--

D3. Diagnosis:

<input type="checkbox"/> Class 0 - No TB exposure, not infected	<input type="checkbox"/> Class 1 - TB exposure, no evidence of infection
<input type="checkbox"/> Class 2 - TB infection, no disease	<input type="checkbox"/> Class 3 - TB, active disease
<input type="checkbox"/> Class 4 - TB, inactive disease	<input type="checkbox"/> Pulmonary <input type="checkbox"/> Extrapulmonary <input type="checkbox"/> Both Sites

D4. RVCT Reported D5. RVCT #: _____

E. U.S. Treatment

<p>E1. U.S. Treatment Initiated:</p> <p><input type="checkbox"/> No Treatment</p> <p><input type="checkbox"/> Active Disease</p> <p><input type="checkbox"/> LTBI</p> <p><input type="checkbox"/> Unknown</p>	<p>E2. U.S. Treatment Start Date: __/__/__</p>	<p>E3. U.S. Treatment Completed:</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>	<p>E4. U.S. Treatment End Date: __/__/__</p>
---	---	---	---

F. Comments

Provider _____

Clinic _____

Phone _____

G. Physician Signature

Panel Physician Signature: _____ Date (mm-dd-yyyy) _____

Completion of the TB Follow-Up Worksheet

Note that a TB Follow-Up Worksheet will only be included for individuals with a TB A, B1, B2 or B3 Classification. This form is generated by DGMQ and is automatically attached to relevant immigrant or refugee files. As such, the MDCH TB Control Program is required to forward this form to local health departments and report completion to DGMQ. The TB Follow-Up Worksheet requires a physician's signature and input, but may be completed by a public health nurse. Your required input on the Worksheet will begin with block C (blocks A and B should already be completed on your form). Unless specifically noted, you may only mark one box for each question. Contact the MDCH TB Control Program with any questions regarding completion of the Follow-Up Worksheet.

1. C1.: Indicate the date of your first evaluation of the patient, regardless of how many or what types of services were performed.
2. C2.a.: Indicate whether you placed a TST on the patient.
C2.b.: If you placed a TST, indicate the date it was placed. If a TST was not placed, leave this and C2.c and C2.d blank.
C2.c.: Indicate the reading of the TST in millimeters.
C2.d.: Indicate your interpretation of the TST result.
C2.e.: Check if the patient had a history of a positive TST. This may be indicated in the overseas examination information or the patient may have other documentation of prior TST status with them. Only check this box for verified, documented prior positive patients; a patient's claim is not sufficient for this purpose.
3. C3.a.: Indicate whether you performed a QuantiFERON (QFT) test on the patient.
C3.b.: If you performed a QFT test, specify the date that blood was collected for the test. If a QFT was not performed, leave this and C3.c blank.
C3.c.: Indicate the result of the QFT test.
4. C4.: Indicate if the patient's overseas chest x-ray is available for your interpretation. This requires the actual film taken during the patient's overseas examination, not an interpretation. If the patient produces a film but it is not clear whether it is really the patient's film (e.g. a substitute), mark "Not Verifiable".
5. C5.: Indicate your interpretation of the patient's overseas chest x-ray. If a film is too unclear to interpret, or of poor quality, mark "Poor Quality" (see #6 below). If you submitted a chest x-ray for interpretation but have not received the result, do not check "Unknown". Rather, hold the Worksheet and attempt to obtain a result from the provider to whom you submitted the x-ray.
6. C6.: If you marked "Abnormal" for C.5., please specify the nature of the abnormality here. Use the "Other" line to indicate any detailed information not covered by the check-boxes. If you marked "Poor Quality" for C5., use the "Other" line to specify that the overseas x-ray was uninterpretable.

7. C7.: Indicate if you obtained a chest x-ray of the patient. If you referred the patient for an x-ray but are uncertain if the x-ray has been performed, do not check “Not Verifiable”. Rather, hold the Worksheet and verify if the x-ray was performed and if not, reschedule with the patient and/or the provider to obtain one.
8. C8.: Specify the date you performed your x-ray of the patient.
9. C9.: Indicate your interpretation of the patient’s x-ray that you obtained. If you submitted a chest x-ray for interpretation but have not received the result, do not check “Unknown”. Rather, hold the Worksheet and attempt to obtain a result from the provider to whom you submitted the x-ray.
10. C10.: If you marked “Abnormal” for C9., please specify the nature of the abnormality here. Use the “Other” line to indicate any detailed information not covered by the check-boxes.
11. C11.: If you have reviewed chest x-rays obtained overseas and through your own health department, indicate how the x-ray you obtained compares to the overseas x-ray. Only mark this question if you have both x-rays films.
12. C12.: Indicate any microscopic or bacteriologic testing (e.g. sputum analysis) that you performed upon specimens you collected from the patient. Do not reference results from the overseas evaluation. If you performed microscopic or bacteriologic testing, indicate the specimen source (e.g. sputum or other clinical specimen) and the date collected.

Indicate the results of AFB smear analysis. Any result indicating the presence of AFB in the specimen, regardless of number, should be marked as “Positive”. If you submitted a specimen for AFB analysis but are unsure of the results, do not mark “Unknown”. Rather, hold the Worksheet and verify the AFB results. If you need help verifying or interpreting AFB results, contact the MDCH TB Control Program. If you know the AFB result for a patient’s specimen, but have not yet received culture or antibiotic sensitivity results, please submit the form including AFB results. This will provide valuable information on the status of the patient, and an updated copy of the form should be submitted when culture and sensitivity results are available.

Indicate the results of bacteriology or culture of the specimen. Final or preliminary culture results of “*M. tuberculosis* complex” or “*M. tuberculosis*” should both be marked as “MTB complex”. Culture results indicating a mycobacterial species other than *M. tuberculosis* should be marked as “NTM” (non-tuberculous mycobacteria). Culture results indicating no growth of any kind, or growth of a non-mycobacterial species, should be marked as “Negative”. If you submitted a specimen for culture analysis but are unsure of the results, do not mark “Unknown”. Rather, hold the Worksheet and verify the culture results. If you need help verifying or interpreting culture results, contact the MDCH TB Control Program.

Indicate the results of antibiotic-sensitivity testing upon the cultured specimen in the “Drug Resistance (DR)” column. Results indicating sensitivity to all antibiotics

tested should be marked as “No DR”. Results indicating resistance to INH only should be marked as “Mono-INH”, and resistance to RIF only as “Mono-RIF”. Results indicating resistance to INH and RIF should be marked as “MDR-TB”. Any other resistance pattern or combination should be marked as “Other DR”. If you need help verify or interpreting results from antibiotic sensitivity testing, contact the MDCH TB Control Program.

- 13.** C13.: Indicate if treatment overseas (prior to entry into U.S.) was recommended by the physician who performed the overseas examination. This is usually specified in the patient’s overseas examination records. If it is unclear whether the overseas physician recommended treatment, mark “Unknown”.
- 14.** C14.: If overseas treatment was recommended, indicate whether the patient received such treatment. Overseas treatment information is usually indicated in the patient’s overseas medical evaluation forms, although the completeness of this information varies greatly among different examination sites and countries. Some patient may also present documentation of treatment separate from their overseas evaluation forms. Only accept clear documentation as evidence of treatment; a patient’s description of treatment is not sufficient. If it is unclear whether the patient received treatment overseas, mark “Unknown”.
- 15.** C15.: Indicate if the patient arrived in the U.S. or your jurisdiction on treatment. This may be apparent in the overseas evaluation files or from the patient’s own description; many patients will recall taking pills and may be able to describe them with some direction from local health staff. Patients may also have bottles of pills or prescriptions with them.
- 16.** C16.: Indicate if the patient completed treatment overseas. This should be based on data from the overseas evaluation documents, or some patients may present copies of treatment regimens or DOT logs from overseas. However, a verbal description by the patient is not sufficient to consider that they completed therapy. The MDCH TB Control Program recommends that any patient not able to provide satisfactory documentation of overseas treatment completion, be regarded as having not completed treatment.
- 17.** C17.: Based upon your review of available information regarding overseas treatment, indicate if you have concerns about that treatment. These concerns may be based upon failure to complete treatment overseas, inadequate or inappropriate regimen prescribed overseas, or any other clinical concern.
- 18.** D1.: Indicate the date you made a disposition for the patient. This may be the date you initiated or prescribed treatment, or the date that you made a determination of the patient’s TB status and a plan for follow-up and management of the patient. The disposition date may be the same date as the initial evaluation, provided that all relevant clinical testing and interpretation is available and documented.
- 19.** D2.: Indicate the outcome of your evaluation.

If you completed your evaluation, indicate if you recommended any TB treatment (LTBI or active disease).

If you initiated an evaluation but were unable to complete it, indicate the reason. If your evaluation is pending further testing, consultation or other needs, please do not report that you were unable to complete your evaluation. Rather, hold your Worksheet until you have the required information and attempt to complete your evaluation. If you are unable to complete your evaluation because the patient moved to another jurisdiction, you will not be held responsible for ensuring that evaluation is completed in the new jurisdiction. Contact the MDCH TB Control Program and provide as much information as possible regarding the patient's new address and location, and our program will refer the patient through the EDN system to the appropriate new jurisdiction.

If you did not initiate an evaluation of the patient, indicate the reason.

- 20.** D3.: Indicate the TB diagnosis you feel is appropriate for the patient. Note that for a diagnosis of "Class 3 – TB, active disease", you must also indicate whether pulmonary, extrapulmonary or both.
- 21.** D4.: Check if you have reported this patient as a case of tuberculosis to the MDCH TB Control Program.
- 22.** D5.: If you have received a state case number for this patient, enter the case number here.
- 23.** E1.: Indicate the type of TB treatment you have initiated for the patient. This question must be answered regardless of your response to D2., thus even if you have not initiated treatment you must indicate "No Treatment". If you have referred the patient to a provider for treatment, but are unsure if treatment has been initiated, please do not mark "Unknown". Rather, hold the Worksheet and contact the provider and the patient to verify that treatment has been initiated or when it will be.
- 24.** E2.: Indicate the date treatment was started or will be started.
- 25.** E3.: Indicate if treatment was completed. Do not mark this box until you have verified and documented that treatment has been completed. For example, a copy of the Worksheet for a patient that has been prescribed INH prophylaxis for LTBI must be submitted when treatment is initiated and again when treatment is completed (~9 months later).
- 26.** E4.: Indicate the date that treatment was ended. This may be the date treatment was completed, or the date that treatment was terminated due to other reasons (e.g. insurmountable side-effects or patient loss to follow-up). If a patient initiates treatment in your jurisdiction but moves to another jurisdiction prior to completing treatment, your jurisdiction will not be held responsible for follow-up or completion of treatment. Contact the MDCH TB Control Program and provide as much information as possible regarding the patient's new address and location, and our program will refer the patient through the EDN system to the appropriate new jurisdiction.

Evaluation of B1 and B2 Tuberculosis Arrivals

Evaluation Activities

Refer to Table 3 for a summary of evaluation tasks to be performed for Class B arrivals.

Table 3: EVALUATION ACTIVITIES FOR B1 AND B2 ARRIVALS¹⁴

Evaluation Activities	Perform Evaluation Activities For		
	B1	B2	B3
Determine TST status. If documentation is not available, administer a TST. A reaction of ≥ 5 mm is considered significant for persons with an abnormal chest radiograph.	Yes	Yes	Yes
Review the overseas chest radiograph and obtain a new radiograph. Even if patients have their overseas chest radiographs available, a new chest radiograph generally should be taken.	Yes	Yes	Yes
Review TB treatment history with the patient. Treatment history may be on the medical examination report, form DS-2053. In some cases, patients have received treatment not documented on the DS-2053.	Yes	Yes	Yes
Collect sputum for testing. The decision to collect sputum specimens should be based on your medical evaluation and review and the patient's information. Sputum specimens should be collected 8 to 24 hours apart, with at least one being an early morning specimen. A chest radiograph does not rule out TB disease with certainty. If the patient is symptomatic, collect sputum specimens regardless of chest radiography results.	Yes	If symptoms present and/or CXR suggests active TB disease.	If symptoms present and/or CXR suggests active TB disease.

Sources: Francis J. Curry National Tuberculosis Center. Recommended TB clinic procedures for Class B1 TB arrivals and recommended TB clinic procedures for Class B2 TB arrivals. In: Text: step-by-step guide. *B Notification Assessment and Follow-up Toolbox* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA; January 2004. Available at: http://www.nationaltbcenter.edu/products/product_details.cfm?productID=WPT-06%20A. Accessed January 25, 2009.

Treatment

Prescribe medications as appropriate. *Do not start patients on single-drug therapy for latent TB infection (LTBI) until tuberculosis (TB) disease is ruled out.* B1/B2 immigrants with positive tuberculin skin tests and for whom active TB has been ruled out are priority candidates for treatment of LTBI because of the increased probability of recent infection and subsequent progression to active TB disease. Patients with fibrotic lesions on a chest radiograph suggestive of old, healed TB are candidates for treatment of LTBI, regardless of age.



The overseas diagnosis of clinically active TB disease is based on the abnormal chest radiograph. Reevaluation in the United States may show the patient actually to have old, healed TB. According to current CDC/American Thoracic Society (ATS) recommendations, old, healed TB can be treated with four months of isoniazid and rifampin using a combined pill, Rifamate (if available), or with nine months of isoniazid.¹⁵



For more information on treatment, see the Treatment of Latent Tuberculosis Infection and Treatment of Tuberculosis Disease sections.

Resources and References

Resources

- California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). “Guidelines for the Follow-up and Assessment of Persons with Class B1/B2 Tuberculosis” (*CDHS/CTCA Joint Guidelines*; September 1999; Accessed January 24, 2009). Available at: <http://www.ctca.org/guidelines/IIA7bnotification.pdf> .
- Centers for Disease Control and Prevention (CDC) Division of Global Migration and Quarantine (DGMQ). “Medical Examinations of Aliens (Refugees and Immigrants)” (CDC Web site; accessed January 24, 2009). Available at: <http://www.cdc.gov/ncidod/dq/health.htm> .
- Centers for Disease Control and Prevention (CDC). *1991 Technical Instructions for Panel Physicians* (CDC Web site; accessed January 24, 2009). Available at: http://www.cdc.gov/ncidod/dq/panel_1991.htm .
- Centers for Disease Control and Prevention (CDC). *2007 Technical Instructions for Tuberculosis Screening and Treatment* (CDC Web site; accessed January 24, 2009). Available at http://www.cdc.gov/ncidod/dq/panel_2007.htm.
- Francis J. Curry National Tuberculosis Center. *B-Notification Assessment and Follow-up Toolbox* (Francis J. Curry National Tuberculosis Center Web site; January 2004; accessed January 24, 2009).

References

- ¹ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.
- ² California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Guidelines for the follow-up and assessment of persons with Class B1/B2 tuberculosis. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. September 1999:1. Available at: <http://www.ctca.org/guidelines/IIA7bnotification.pdf> . Accessed January 26, 2009.
- ³ Francis J. Curry National Tuberculosis Center. Overview. *B Notification Assessment and Follow-up Toolbox* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA; January 2004:2–3. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=WPT-06%20A . Accessed January 26, 2009.
- ⁴ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.
- ⁵ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.
- ⁶ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.
- ⁷ Congress of the United States, Congressional Budget Office. *A Description of the Immigrant Population*. Washington, DC: Congressional Budget Office; November 2004:2. Available at: <http://www.cbo.gov/ftpdocs/60xx/doc6019/11-23-Immigrant.pdf> . Accessed January 26, 2009.
- ⁸ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):46.
- ⁹ Congress of the United States, Congressional Budget Office. *A Description of the Immigrant Population*. Washington, DC: Congressional Budget Office; November 2004:2. Available at: <http://www.cbo.gov/ftpdocs/60xx/doc6019/11-23-Immigrant.pdf> . Accessed January 26, 2009.

-
- ¹⁰ ATS, CDC, IDSA. Controlling tuberculosis in the United States: recommendations from the American Thoracic Society, CDC, and the Infectious Diseases Society of America. *MMWR* 2005;54(No. RR-12):34.
- ¹¹ California Department of Health Services (CDHS)/California Tuberculosis Controllers Association (CTCA). Guidelines for the follow-up and assessment of persons with Class B1/B2 tuberculosis. *CDHS/CTCA Joint Guidelines* [CTCA Web site]. September 1999:1. Available at: <http://www.ctca.org/guidelines/IIA7bnotification.pdf> . Accessed January 26, 2009.
- ¹² Tuberculosis Control Program. *B1/B2 Notification and Monitoring Procedures*. New York State Department of Health. April 1996 in Text: step-by-step guide. *Notification Assessment and Follow-up Toolbox*. Francis J. Curry National Tuberculosis Center [Francis J. Curry National Tuberculosis Center Web site]. January 2004. Available at: http://www.nationaltbcenter.edu/products/product_details.cfm?productID=WPT-06%20A . Accessed January 26, 2009.
- ¹³ Francis J. Curry National Tuberculosis Center. Class A and B immigrant TB follow-up protocol. In: Text: step-by-step guide. *B Notification Assessment and Follow-up Toolbox* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA; January 2004. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=WPT-06%20A .Accessed January 26, 2009.
- ¹⁴ Francis J. Curry National Tuberculosis Center. Recommended TB clinic procedures for Class B1 TB arrivals and recommended TB clinic procedures for Class B2 TB arrivals. In: Text: step-by-step guide. *B Notification Assessment and Follow-up Toolbox* [Francis J. Curry National Tuberculosis Center Web site]. San Francisco, CA; January 2004. Available at: http://www.nationaltbcenter.ucsf.edu/products/product_details.cfm?productID=WPT-06%20A .Accessed January 26, 2009.
- ¹⁵ ATS, CDC, IDSA. Treatment of tuberculosis. *MMWR* 2003;52(No. RR-11):650–651.