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Surveillance

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Forms Used in this Section

- [Acknowledgement of TB Counseling](#) (PHSKC)
- [Authorization for Care Coordination](#) (PHSKC)
- [Authorization for Disclosure of Protected Health Information](#) (PHSKC)
- [Civil Detention Flowchart](#)
- [Clinic Record](#) (SHD)
- [Contact Investigation](#)
- [DOT Agreement](#) (PHSKC)
- [DOT Agreement](#) (Virginia)
- [Home Evaluation](#) (SHD)
- [Home Isolation Agreement](#) (SHD)
- [Interjurisdictional TB Notification](#)
- [Interjurisdictional TB Notification Follow-Up](#)
- [Laboratory Data Sheet](#)
- [RVCT Form](#) (CDC)
- [Public Health Directive](#) (PHSKC)
- [Public Health Directive \(Non-Compliance\)](#) (PHSKC)

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 web application for reporting TB ([PHIMS TB](#)) 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 the 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 Report of Verified Case of Tuberculosis (RVCT) forms (both the [CDC version](#) and the Washington State electronic PHIMS TB edition) are designed to collect information on cases of TB. 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 of the manual (**2.8**).



In the WAC, see Chapter 246-101 (Notifiable Conditions) in the Title 246 (Department of Health) at <http://apps.leg.wa.gov/wac/default.aspx?cite=246-101>

Also, see Notifiable Conditions Guidelines, at <http://www.doh.wa.gov/notify/guidelines/pdf/tuberculosis.pdf>

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, mode of transmission, 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 of the manual (**9.45**).

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 of the manual ([9.1](#)).

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 “Targeted Testing for Latent Tuberculosis Infection” at <http://www.cdc.gov/mmwr/PDF/rr/rr4906.pdf>

Treatment of LTBI: Surveillance of persons with LTBI does not routinely occur in the United States. However, the CDC has a National Surveillance System for Severe Adverse Events Associated with Treatment for Latent Tuberculosis Infection. This system collects data on patients who received at least one dose of drug therapy for treatment of LTBI resulting in hospitalization or death. Healthcare providers are encouraged to report such events to the CDC's Division of Tuberculosis Elimination by calling 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 <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5231a4.htm> .

Policy

Data collection and reporting on TB should be done in accordance with Washington State laws and regulations. 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 section of the manual ([1.16](#)).



For more information on confidentiality and the Health Insurance Portability and Accountability Act (HIPAA), see the Confidentiality section of the manual ([12.3](#)).

Laws and Rules

Washington State laws and rules on tuberculosis (TB) are located in the Washington Administrative Code (WAC) and the Revised Code of Washington (RCW).



In the WAC, see Chapter 246-170 (Tuberculosis Control) in Title 246 (Department of Health) at <http://apps.leg.wa.gov/WAC/default.aspx?cite=246-170>



In the RCW, see chapter 70.28 (Control of Tuberculosis) at <http://apps.leg.wa.gov/RCW/default.aspx?cite=70.28>



In the WAC, see Chapter 246-101 (Notifiable Conditions) in the Title 246 (Department of Health) at <http://apps.leg.wa.gov/wac/default.aspx?cite=246-101>

Also, see Notifiable Conditions Guidelines, at <http://www.doh.wa.gov/notify/guidelines/pdf/tuberculosis.pdf>



Contact Washington State TB Services at 360-236-3443 for assistance with interpreting Washington 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 TB exposure Not infected 	<ul style="list-style-type: none"> No history of TB exposure and no evidence of <i>M.tuberculosis</i> infection or disease 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 to <i>M. tuberculosis</i> Negative reaction to the TST or IGRA (given at least 8-10 weeks after exposure)
2	<ul style="list-style-type: none"> TB infection No TB disease 	<ul style="list-style-type: none"> Positive reaction to the TST or IGRA Negative bacteriological studies (smear and cultures) No bacteriological or radiographic evidence of active TB disease
3	<ul style="list-style-type: none"> TB Clinically active 	<ul style="list-style-type: none"> Positive culture for <i>M. tuberculosis</i> Positive reaction to TST or IGRA, plus clinical, bacteriological, or radiographic evidence of current active TB
4	<ul style="list-style-type: none"> Previous TB disease (not clinically active) 	<ul style="list-style-type: none"> May have past medical history of TB disease Abnormal but stable radiographic findings Positive reaction to the TST or IGRA Negative bacteriologic studies (smear and cultures) <p>And</p> <ul style="list-style-type: none"> No clinical or radiographic evidence of current active TB disease
5	<ul style="list-style-type: none"> TB suspected 	<ul style="list-style-type: none"> Signs and symptoms of active TB disease, but medical evaluation not complete

Source: Adapted from: CDC. Classification system. In: Chapter 2: transmission and pathogenesis. *Core Curriculum on Tuberculosis (2011)* [Division of Tuberculosis Elimination Web site]. Available at: <http://www.cdc.gov/tb/education/corecurr/index.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 Washington State law and regulation, a case of TB disease in the United States must be reported to the local public health jurisdiction (2.10).

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 that meets all of the following criteria:</p> <ul style="list-style-type: none"> • A positive tuberculin skin test or IGRA • 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 of the manual ([4.1](#)).



In the WAC, see Chapter 246-101 (Notifiable Conditions) in the Title 246 (Department of Health) at <http://apps.leg.wa.gov/wac/default.aspx?cite=246-101>

Also, see Notifiable Conditions Guidelines, at <http://www.doh.wa.gov/notify/guidelines/pdf/tuberculosis.pdf>

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 jurisdiction to do the following quickly:

- Verify diagnosis
- Assign a case manager and coordinate treatment
- Determine if an outbreak is occurring
- Control the spread of TB²⁰

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 Confirmed Cases of Tuberculosis

Report 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 cases of tuberculosis (TB) disease This includes pulmonary and extrapulmonary cases.</p>	<p>Healthcare Providers or Anyone providing treatment to the confirmed case</p> <p>Note: The attending physician or other healthcare provider must report even if the laboratory is also reporting the test results.</p>	<p>Report Immediately</p>	<p>Notify the local health jurisdiction in the county of the patient's residence.</p> <p>For a list of local public health jurisdictions in Washington State and their contact information, refer to this document: http://www.doh.wa.gov/LHJMap/LHJMap.htm.</p> <p>WAC 246-101-101 Notifiable Conditions and the health care provider</p> <p>Also, see Notifiable Conditions Guidelines, at http://www.doh.wa.gov/notify/nc/tuberculosis.htm</p>
<p>Confirmed cases of tuberculosis (TB) disease This includes pulmonary and extrapulmonary cases.</p>	<p>Hospitals and other similar private or public institutions</p> <p>Note: The attending physician or other healthcare provider must report even if the laboratory is also reporting the test results.</p>	<p>Report Immediately</p>	<p>Notify the local health jurisdiction in the county of the patient's residence.</p> <p>For a list of local public health jurisdictions in Washington State and their contact information, refer to this document: http://www.doh.wa.gov/LHJMap/LHJMap.htm.</p> <p>WAC 246-101-301 Notifiable Conditions and health care facilities</p> <p>Also, see Notifiable Conditions Guidelines, at http://www.doh.wa.gov/notify/nc/tuberculosis.htm</p>
<p>Mycobacterium tuberculosis</p>	<p>Laboratories</p>	<p>Report culture within 2 business days</p>	<p>Notify the Department of Health</p> <p>DOH TB Reporting Line: 360-236-3397 Or DOH TB Reporting Fax Line: 360-236-3405</p> <p>WAC 246-101-201 Notifiable Conditions and laboratories</p> <p>Also, see Notifiable Conditions Guidelines, at http://www.doh.wa.gov/notify/nc/tuberculosis.htm</p>

What Condition/ Test Result	Who Reports	When to Report	How to Report
Mycobacterium tuberculosis (antibiotic sensitivity for first isolates)	Laboratories	Report within 2 business days	Notify the Department of Health DOH TB Reporting Phone Line: 360-236-3397 Or DOH TB Reporting Fax Line: 360-236-3405 WAC 246-101-201 Notifiable Conditions and laboratories Also, see Notifiable Conditions Guidelines, at http://www.doh.wa.gov/notify/nc/tuberculosis.htm

Healthcare Providers

Responsibilities of Private Medical Providers ([WAC 246-101-105](#))

1. Notify the local health jurisdiction where the patient resides (in the event that patient residence cannot be determined, notify the local health jurisdiction where the health care providers practice) regarding:
 - a. Cases or suspected cases of notifiable conditions specified as notifiable to local health jurisdiction in Table [HC-1](#);
 - b. Cases of conditions designated as notifiable by the local health officer within that health officer's jurisdiction;
 - c. Outbreaks or suspected outbreaks of disease. These patterns include, but are not limited to, suspected or confirmed outbreaks of chickenpox, influenza, viral meningitis, nosocomial infection suspected due to contaminated food products or devices, or environmentally related disease;
 - d. Known barriers which might impede or prevent compliance with orders for infection control or quarantine; and
 - e. Name, address, and other pertinent information for any case, suspected case or carrier refusing to comply with prescribed infection control measures.
2. Notify the department of health of conditions designated as notifiable to the local health jurisdiction when:
 - a. A local health jurisdiction is closed or representatives of the local health jurisdiction are unavailable at the time a case or suspected case of an immediately notifiable condition occurs;

- b.** A local health jurisdiction is closed or representatives of the local health jurisdiction are unavailable at the time an outbreak or suspected outbreak of communicable disease occurs.
- 3.** Notify the jurisdiction of pesticide poisoning that is fatal, causes hospitalization or occurs in a cluster.
- 4.** Notify the jurisdiction as specified in Table [HC-1](#) regarding cases of notifiable conditions specified as notifiable to the jurisdiction.
- 5.** Assure that positive cultures and preliminary test results for notifiable conditions of specimens referred to laboratories outside of Washington for testing are correctly notified to the local health jurisdiction of the patient's residence or the jurisdiction as specified in [Table Lab-1](#). This requirement can be satisfied by:
 - a.** Arranging for the referral laboratory to notify either the local health jurisdiction, the department, or both; or
 - b.** Forwarding the notification of the test result from the referral laboratory to the local health jurisdiction, the department, or both.
- 6.** Cooperate with public health authorities during investigation of:
 - a.** Circumstances of a case or suspected case of a notifiable condition or other communicable disease; and
 - b.** An outbreak or suspected outbreak of disease.
- 7.** Provide adequate and understandable instruction in disease control measures to each patient who has been diagnosed with a case of a communicable disease, and to contacts who may have been exposed to the disease.
- 8.** Maintain responsibility for deciding date of discharge for hospitalized tuberculosis patients.
- 9.** Notify the local health officer of intended discharge of tuberculosis patients in order to assure appropriate outpatient arrangements are arranged.

Laboratories

Responsibilities of Laboratories ([WAC 246-101-201](#))

This section describes the conditions about which Washington's laboratories must notify public health authorities of on a statewide basis. The board finds that the conditions in [Table Lab-1](#) are notifiable for the prevention and control of communicable and noninfectious diseases and conditions in Washington. The board also finds that submission of specimens for many of these conditions will further prevent the spread of disease. Laboratory directors must notify public health authorities of positive cultures and preliminary test results as individual case reports and provide specimen submissions using procedures described throughout this chapter. Local health officers may require additional conditions to be notifiable within the local health officer's jurisdiction.

WAC [246-101-205](#), [246-101-210](#), [246-101-215](#), [246-101-220](#), [246-101-225](#), and [246-101-230](#) also include requirements for how notifications and specimen submissions are made, when they are made, the content of these notifications and specimen submissions, and how information regarding notifiable conditions cases must be handled and may be disclosed.

Required Reports from Local Public Health Jurisdictions to Washington State Tuberculosis Services

Local public health jurisdictions are required to complete and submit the reports listed in Table 4 to Washington State TB Services at the Washington State Department of Health.

Contact Investigation forms can be faxed to the attention of the Washington State TB Services at 360-236-3405 or mail to:

Washington State TB Services

Mailing address: P.O. Box 47837 Olympia, WA 98504

Physical address: 111 Israel Rd SE Tumwater, WA 98501

TABLE 4: REQUIRED REPORTS

Report Title	When Due
<ul style="list-style-type: none"> PHIMS TB 	Within 7 days of receipt of confirmed/suspect case notification by the local health jurisdiction
<ul style="list-style-type: none"> PHIMS TB 	When there are changes to the TB Case Report and when the TB case is closed (the end of treatment)
<ul style="list-style-type: none"> Contact Investigation 	<p>At these milestones during a contact investigation of exposure to pulmonary TB:</p> <ul style="list-style-type: none"> Upon completion of <u>initial</u> tuberculin skin testing or IGRA testing of contacts (usually 10-15 days) Upon completion of retests of contacts Upon contacts' completion of therapy for latent tuberculosis infection Submit the "TB Contact Investigation Form" to WA State TB Services within 2 weeks <p>For recommended time frames of tasks in contact investigations, refer to the "Time Frames for Contact Investigation" topic in the Contact Investigation section of the manual (9.16).</p>



To download forms for the above required reports, go to the **FORMS** section of the manual.



In the WAC, see Chapter 246-101 (Notifiable Conditions) in the Title 246 (Department of Health) at

<http://apps.leg.wa.gov/wac/default.aspx?cite=246-101>

Also, see Notifiable Conditions Guidelines, at

<http://www.doh.wa.gov/notify/guidelines/pdf/tuberculosis.pdf>

Data Collection Forms

It is recommended that the following standardized forms (or similar forms developed by local health jurisdictions) be completed and placed in the patient’s chart and/or a contact investigation file if and when the related activities are performed.

TABLE 5: RECOMMENDED FORMS FOR A TUBERCULOSIS PATIENT’S CHART

Chart of a Patient on Treatment for Tuberculosis Disease	
<p>Tuberculosis (TB) Disease Treatment/Case Management</p> <ul style="list-style-type: none"> • RVCT Form (printed version from PHIMS) • Dot Agreement (Virginia) • Home Isolation Agreement (SHD) • Home Evaluation (SHD) • Laboratory Data Sheet • Clinic Record (SHD) • Acknowledgement of TB Counseling (PHSKC) • Public Health Directive (PHSKC) • Public Health Directive (Non-Compliance) (PHSKC) • Authorization for Care Coordination (PHSKC) • Disclosure of Protected Health Information (PHSKC) • Civil Detention Flowchart 	<p>Transfer Notifications</p> <ul style="list-style-type: none"> • Interjurisdictional TB Notification • Interjurisdictional TB Notification Follow-Up
Chart of a Patient on Treatment for Latent Tuberculosis Infection	
<p>Latent Tuberculosis Infection (LTBI) Treatment</p> <ul style="list-style-type: none"> • Clinic Record (SHD) 	<p>If on Directly Observed Therapy</p> <ul style="list-style-type: none"> • DOT Agreement (Virginia) • DOT Agreement (PHSKC) <p>Transfer Notifications</p> <ul style="list-style-type: none"> • Interjurisdictional TB Notification • Interjurisdictional TB Notification Follow-Up
File for a Contact Investigation	
<ul style="list-style-type: none"> • Contact Investigation • Contact Investigation Instructions 	



To download the above recommended forms, go to the **FORMS** section of the manual.

PHIMS TB (Public Health Issue Management System)

To carry out mandatory community public health responsibilities, the state TB control program maintains a web-based reporting system where up-to-date information on all current clinically active and suspected TB cases in the community can be entered and accessed. The PHIMS TB program should ensure that laboratory data, including all initial positive diagnostic tests, are promptly reported to the Department of Health by the local health jurisdictions (LHJs). 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. Aggregate program data should be analyzed, interpreted, and made available to the healthcare community and to community groups and organizations with specific interests in public health. Providing this information supports education and advocacy and facilitates collaboration in the planning process.

- Local Health Jurisdictions will use PHIMS TB to:
 - Report TB suspects and cases to DOH
 - Enter current clinical information and updates
 - View case summary reports and exports
 - Document quality assurance and cohort data



For more information on the TB PHIMS program, see the PHIMS TB User Guide at: <http://www.doh.wa.gov/cfh/TB/publications/PHIMS.pdf>

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
- The development of two new methods, spoligotyping and mycobacterial interspersed repetitive units (MIRU) analysis, which are based on polymerase chain reaction (PCR) and provide much more rapid results than RFLP analysis²²

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.

The Washington State TB Services reviews genotyping data to check for any matches. Upon identification of a match, Washington State TB Services telephones the local health jurisdictions managing the case to discuss what further steps should be taken.



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* (2004) at <http://www.cdc.gov/tb/programs/genotyping/manual.htm> .



All *M. tuberculosis* cultures originating at the Washington State Public Health Laboratory are automatically submitted to a national genotyping laboratory for genotyping analysis.



For more information on Restriction Fragment Length Polymorphism (RFLP) see http://www.cdc.gov/tb/programs/genotyping/Chap5/5_Developing_3c_RFLP.htm.

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