

Tuberculosis

Definition: Tuberculosis (TB) is an infectious, inflammatory communicable disease that most commonly attacks the lungs, although it can occur in almost any part of the body. The causative agent, the tubercle bacillus (*Mycobacterium tuberculosis*), is spread through the air. ICD-9 codes 010-018. People who have a positive tuberculin skin test but no clinical or radiographic evidence of TB are considered to have latent TB infection (LTBI) and are non-infectious.

Summary

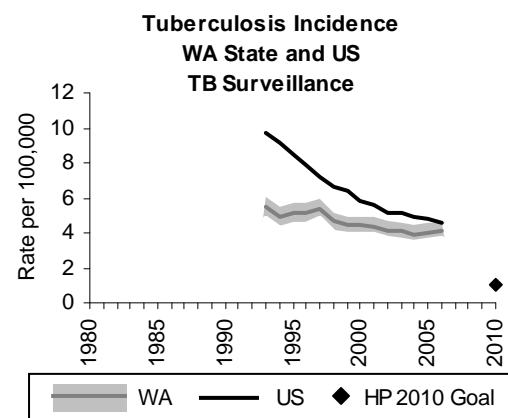
In 2006, Washington State reported 262 cases of tuberculosis. The [crude incidence rate](#) was 4.1 cases per 100,000. This rate was slightly less than the national rate of 4.6 per 100,000. Washington ranks 20th in the United States in tuberculosis incidence. Seventy-three percent of the 2006 tuberculosis cases in Washington were among foreign-born people from countries with high rates of tuberculosis.

Time Trends

Tuberculosis is transmitted from person to person. When a person with pulmonary or laryngeal tuberculosis coughs or sneezes, droplets containing *Mycobacterium tuberculosis* (*M. tuberculosis*) are expelled into the air. These tiny particles can remain suspended in the air for several hours. If another person inhales air containing these droplet nuclei, infection with tuberculosis can occur.

From the early 1940s until the mid-1980s, tuberculosis cases steadily decreased in Washington, paralleling the national trend. Better living conditions, reduced crowding, improved nutritional status, and the introduction of effective chemotherapy contributed to these declines. But from 1984 until 1991, the number of tuberculosis cases increased by 49%, primarily because of increases in immigration from areas of endemic tuberculosis, erosion of the public health infrastructure for ensuring treatment and control, and to a lesser extent, the HIV epidemic. In Washington, the impact of HIV on tuberculosis has been significantly less than in other parts of the country. During 2004–2006, only about 5% of tuberculosis cases occurred in people with HIV infection.

In Washington, case rates have remained relatively stable since 2000. Meanwhile, national case rates have continued to decline, although at a slower rate.



Year 2010 Goals

The *Healthy People 2010* goal for TB incidence is no more than 1.0 new case per 100,000.¹ Following continued declines in the state rate since 1991, the rate increased in 2005 and 2006. Because of proportional increases of TB among foreign-born people from places where TB is endemic and without the advancement of new medications and testing technologies, it is unlikely that Washington will meet this target by 2010. The maintenance of control and prevention of new transmissions and outbreaks are reasonable goals for Washington.

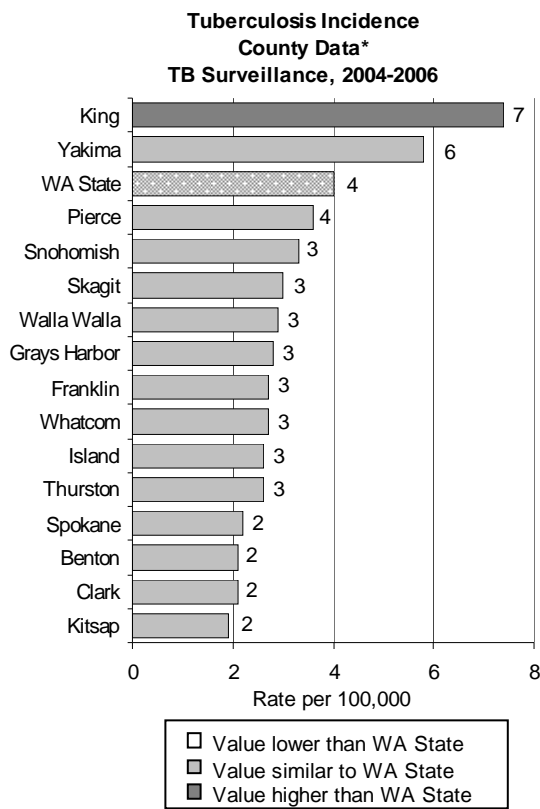
Another goal is to increase the proportion of all TB patients who complete curative therapy within 12 months to at least 90%. Washington has reached this target; during 2004–2006, 93% of tuberculosis patients here completed the recommended regimen within 12 months.

A third national goal is to increase the proportion of contacts and other high-risk people with latent TB infection (LTBI) who complete a course of treatment to at least 85%. In 2005, 78% of infectious cases

identified a contact, and 77% of contacts who started treatment successfully completed it.

Geographic Variation

From 2004–2006, Washington’s average annual tuberculosis incidence rate was 4.1 per 100,000. Nine counties had no cases during this period; only 15 counties had enough cases so that rates could be reliably calculated. Rates in two of these counties (King and Yakima) were above the average state rate. In 2006, 34 of Washington’s 39 counties had 10 or fewer cases of tuberculosis. King County accounted for 145 (55%) of the 262 cases and had an incidence rate of 7.9 per 100,000.



*Counties not displayed had too few cases to support a reliable rate estimate and were omitted.

Age and Gender

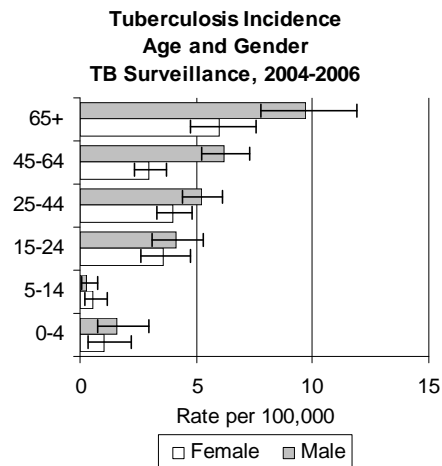
From 2004–2006, age-specific tuberculosis rates in Washington were highest among people ages 45 and older, particularly males. Rates of TB in people age 44 and younger are typically higher among foreign-born people than those born in the United States. This disparity might be caused by more recent exposure to disease among

people arriving from other countries, many of whom are younger than 45.

In addition to the health concerns for affected children, the occurrence of TB among individuals younger than five years represents a sentinel marker for TB transmission in a community.² The incidence rate of tuberculosis among U.S.-born children younger than five in Washington is relatively low. The rate of tuberculosis in U.S.-born 5–14 year-olds has decreased slightly over the past few years.

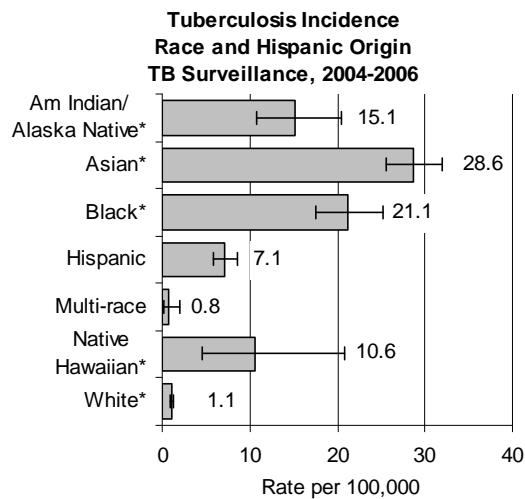
Males accounted for 59% of all tuberculosis cases during 2004–2006. Among foreign-born cases, 56% were male and 44% were female. Among U.S.-born cases, 67% were male and 33% were female.

The pervasiveness of TB exposure in other countries might account for the higher proportion of cases in foreign-born women as compared to U.S.-born women.



Race and Hispanic Origin

From 2004–2006, Asians, blacks, and American Indians and Alaska Natives had the highest rates of TB relative to whites. Increased rates might result from a greater proportion of non-whites having other risk factors for tuberculosis, such as previously living in tuberculosis-endemic countries such as Vietnam, Mexico, and the Philippines. People from these three countries accounted for nearly 50% of tuberculosis cases among the foreign-born. Lower socioeconomic position, lack of access to medical care, and lack of health insurance are other possible risk factors that might contribute to higher tuberculosis rates among racial minorities and people of Hispanic origin.³



Foreign-born people account for more than half of all TB cases reported in the United States and in Washington.⁴ During 2004–2006, 69% of all new tuberculosis cases reported in Washington occurred in foreign-born people. Many of these arrived infected.

Overseas local physicians designated by U.S. consuls screen immigrants and refugees who want to enter the United States. The overseas screening process for TB has been well documented; 3%–14% of immigrants who are non-infectious but have abnormal chest x-rays are infected with active TB after arrival in the United States. In contrast to the overseas program, less comprehensive data are available to determine the number of people arriving with TB from the U.S. screening program. In addition, the number of foreign-born people not screened or screened and treated for TB infection through mechanisms other than the formal immigration process is not known.⁴

Income and [Education](#)

Income and educational information are not currently collected on TB case report forms. But the 2004 *Health of Washington State Supplement* reported income and education characteristics in census tracts with TB cases.⁵ These data showed that poverty but not education was significantly associated with tuberculosis rates. This finding differs from the association of higher rates of tuberculosis with lower educational attainment seen nationally.²

Other Measures of Impact and Burden

Drug resistance. All cultures of *M. tuberculosis* in Washington are tested for drug sensitivity. All local health jurisdictions, hospitals, and laboratories doing mycobacteriology send specimens for initial or reference testing to the Washington State Department of Health Public Health Laboratories.

Testing from 2004–2006 revealed that of the 597 tuberculosis case specimens available for analysis, 106 (18%) were resistant to at least one antituberculosis drug. Only nine people (2%) had specimens that were multi-drug resistant (that is, resistant to both isoniazid and rifampin). In 2006, drug resistance was slightly higher in specimens collected from foreign-born people (19%) than in specimens from U.S.-born people (16%). Extensive Drug Resistant TB (also referred to as Extreme Drug Resistance or XDR-TB) is multi-drug-resistant TB that is also resistant to three or more of the six classes of second-line drugs, including at least one of the injectable agents. There have been no cases of XDR-TB reported in Washington to date.

Mortality. In 2006, 18 death certificates listed TB. TB caused one of these 18 deaths and was listed as a factor contributing to the other 17.

Risk and Protective Factors

Transmission. About 10% of people infected with tuberculosis develop disease at some point later in their lives. (Half of these people develop the disease within two years.) The remainder of infected people remain latently infected without developing active disease. The extended latent period between acquisition of infection and development of active disease (LTBI) provides an opportunity to prevent disease from developing. (See below.)

Conditions that increase the risk of tuberculosis transmission. Tuberculosis transmission depends on three factors: the *infectivity* of the person with tuberculosis, the *environment* in which exposure occurred, and the *duration* of exposure.

People at the highest risk of becoming infected are those who have close contact with and spend significant periods of time with people with infectious tuberculosis (e.g., house or shelter mates, relatives, friends, and sometimes coworkers). A second group is people whose immune systems are compromised because of organ transplants, HIV, or for some other reason and who are exposed to individuals with TB. Although transmission rates cannot be calculated, LTBI incidence rates among close contacts are relatively stable, ranging from 20% to 23%.³

Conditions that increase the risk of tuberculosis disease. Many conditions can increase the likelihood that LTBI will progress to disease. Among these are children younger than five, HIV infection, substance abuse (especially drug injection), recent infection with *M. tuberculosis*, chest radiograph findings suggestive of previous tuberculosis (in a person inadequately treated), diabetes mellitus, silicosis, low body weight, cancer of the head and neck, hematological and reticuloendothelial diseases (i.e., leukemia or Hodgkin's disease), end-stage renal disease, intestinal bypass or gastrectomy, chronic malabsorption syndromes, prolonged corticosteroid therapy, and other immunosuppressive therapies.

Preventive therapy. Preventive therapy substantially reduces the risk that LTBI will progress to disease. Certain groups are at high risk of developing tuberculosis disease once infected. High priority candidates for preventive therapy are people with a positive skin test in the following high-risk groups, regardless of age:

- People known to have HIV infection
- Close contacts of a person with infectious tuberculosis
- People who have an x-ray suggestive of previous tuberculosis and who did not complete adequate treatment
- People with the medical conditions that increase the risk of tuberculosis disease (see above)
- Recent tuberculin skin test converters.

Intervention Strategies

The best way to stop transmission of tuberculosis is to isolate infectious patients immediately and start effective antituberculosis therapy. Infectivity declines rapidly after adequate therapy begins but might be complicated if the patient does not adhere to the prescribed regimen and/or has a drug resistant tuberculosis strain.

Clinicians should promptly report all new and suspected tuberculosis cases to the local health jurisdiction. Early reporting is essential for the timely evaluation of people who have been in contact with the tuberculosis patient. Local health jurisdictions initiate contact investigations, starting with the close contacts that are most likely to have LTBI, young children, and HIV-infected people. These investigations identify high-risk individuals so that they can receive

skin tests, chest x-rays, and if appropriate, preventive or curative therapy.

Adherence. Nonadherence to therapy is a major threat to tuberculosis control. Inadequate, delayed, or erratic treatment can lead to relapse, continued transmission, and drug resistance. Nationally, about 20% of people receiving treatment for tuberculosis disease do not complete a recommended regimen within 12 months.³ During 2004–2006, 7% of tuberculosis patients in Washington did not complete the recommended regimen within 12 months.

One way to ensure that patients adhere to therapy is to use directly observed therapy (DOT), in which a health care worker watches the patient swallow each dose of antituberculosis medication. DOT has been shown to be cost-effective. It can lead to significant reductions in relapse and acquired drug resistance.³ In Washington from 2003–2005, approximately 91% of cases were on DOT or a combination of DOT and self-administration. DOT and case management is a recommended strategy for all people with infectious TB.

Screening and treatment of the foreign-born. The most common cause of TB reactivation in the foreign born is not being treated. Not being screened for TB upon arrival contributes to reactivation because disease is not detected, leading to immune system decline. Following are other problems associated with current screening and follow-up requirements.⁶

- People enter the United States with active tuberculosis, meaning that the required medical examinations either missed or failed to report the disease or no screening was done or required.
- Refugees screened overseas who are negative for TB disease or LTBI at the time of examination might spend up to a year in crowded refugee camps awaiting departure to the United States. They have a high likelihood of exposure to or activation of infectious TB during this waiting period.
- People with tuberculosis might enter the United States under a waiver but fail to comply with waiver provisions calling for further examinations and/or therapy.
- Some people arrive in the United States with inadequately treated or drug-resistant tuberculosis.
- People in certain visa classifications might enter the United States for extended periods without

being required to have a medical evaluation for tuberculosis.

- People with tuberculosis might come to the United States as visitors specifically to obtain treatment for tuberculosis.

As long as these screening deficiencies and the consequent absence of preventive treatment of infected people continue, substantially higher tuberculosis rates in the foreign-born residents of Washington will continue.

Advancements in technology. Changes in the technology used to prevent, diagnose, and treat TB are required in order to achieve further decreases in TB rates in Washington and reach the *Healthy People 2010* target.

One advancement is the development of a more specific testing method for detecting TB infection. The traditional testing method (the tuberculin skin test) requires two tests over a three-month period and is not always accurate. But blood-based testing (e.g., Quantiferon Gold, Elispot) provides patients and providers more certainty that a positive test result signifies infection. This, in turn, might enhance willingness to complete treatment and eliminate time and resources spent on people not truly infectious. Adoption of this technology is still in the early stages but ultimately may replace the tuberculin skin test.

Other technology developments include the current use of testing to enhance early confirmation of suspected TB cases, development and testing of new and existing drugs to shorten and simplify treatment, and exploration of a vaccine.

Data Sources

State tuberculosis data: Washington State Department of Health, Tuberculosis Information Management (TIMS), 1993–2006.

National tuberculosis data: U.S. Centers for Disease Control and Prevention

For More Information

Washington State Department of Health, Tuberculosis Control Program, (360) 236-3443

Technical Notes

Foreign-born: The term foreign-born indicates any person not born in the United States or its territories (e.g., Puerto Rico) and protectorates (e.g., Guam and American Samoa). The TB case report records the month and year that these people entered the United States. It is important

to note that even though these people are born outside the United States, they might have resided here for any length of time, although the exact duration might be inaccurate or unknown.

Endnotes

¹ U.S. Department of Health and Human Services. (Eds.). (2000). *Healthy People 2010: Understanding and Improving Health* (2nd ed.). Washington, DC: U.S. Government Printing Office.

² Friedman, L. N. (Ed.). (2001). *Tuberculosis: Current Concepts and Treatment* (2nd ed.). Boca Raton, FL: CRC Press.

³ U.S. Centers for Disease Control and Prevention. (2003). *The Social and Cultural Dimensions of Health-Seeking Behaviors*. Atlanta, GA: U.S. Division of TB Elimination.

⁴ U.S. Centers for Disease Control and Prevention. (1998). Recommendations for Prevention and Control of Tuberculosis Among Foreign-Born People Report of the Working Group on Tuberculosis Among Foreign-Born People. Retrieved March 1, 2007, from <http://www.cdc.gov/mmwr/preview/mmwrhtml/00054855.htm>

⁵ Washington State Department of Health. (2004). The Health of Washington State 2004 Supplement. Retrieved April 1, 2007, from http://www.doh.wa.gov/HWS/doc/ID/ID_TB2004.doc

⁶ U.S. Centers for Disease Control and Prevention. (1990). Tuberculosis Among Foreign-Born People Entering the United States. Recommendations of the Advisory Committee for Elimination of Tuberculosis. *Morbidity and Mortality Weekly Reports*, 39(RR-18), 1-13, 18-21.