



# *X-Plain™* *Tuberculosis*

## Reference Summary

Tuberculosis, or TB, is a bacterial infection that causes more deaths in the world than any other infectious disease. About 2 billion people are infected with tuberculosis worldwide. In the United States, about 15 million people are infected.

When tuberculosis becomes active, it kills 60% of those who are not treated. This amounts to 3 million deaths worldwide every year. In the United States, about 20,000 tuberculosis infections become active every year.

There is a treatment for tuberculosis. When treated, 90% of patients who have an active tuberculosis infection survive.

This reference summary explains latent and active tuberculosis infections. The program discusses the diagnosis, treatment, and prevention of tuberculosis.

### **Causes**

Tuberculosis is an infection caused by a bacterium called *Mycobacterium tuberculosis*. The bacterium is also called *tubercle bacillus*.

Tuberculosis spreads from person to person through air as a person with active tuberculosis coughs, sneezes, or expels air.

After a person becomes infected, the tuberculosis bacteria are controlled by the person's immune system. The infection becomes latent, or confined. When the bacteria spread out of control, the infection becomes active.

Since most infected people breathe out only a few bacilli when they exhale, transmission of tuberculosis usually only occurs after one or more months of exposure to someone with active tuberculosis.



Adequate ventilation is the most important measure to prevent the transmission of tuberculosis.

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Tuberculosis is not usually transmitted through personal items belonging to those with tuberculosis, such as clothing, bedding, or other items they have touched.

### **Latent vs. Active Infection**

As a person breathes infected air, the bacilli go to the lungs through the *bronchioles*.

At the end of the bronchioles are *alveoli*. Alveoli are balloon-like sacs where the blood takes oxygen from inhaled air and releases carbon dioxide into the air exhaled.

Tuberculosis bacilli infect the alveoli. The body's immune system fights them. The immune system includes special blood cells that identify and destroy foreign material, including viruses and bacteria. These blood cells are called white blood cells.

Special white blood cells called *macrophages* attack tuberculosis bacteria. Many of the bacteria die.

Tuberculosis bacteria have a cell wall made of a complex waxy material. This wall protects some bacteria inside the macrophage!

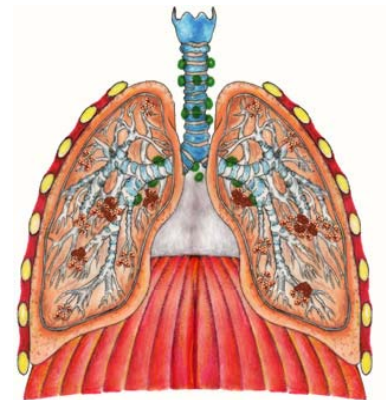
Special cells of the immune system surround and separate the infected macrophages. The mass resulting from the separated, infected macrophages are hard, grayish nodules called *tubercles*.

If an infected person is not healthy, particularly if he or she has a weak immune system, the bacilli may overwhelm the immune system. The bacilli could break out of the tubercles in the alveoli and spread to the lungs and other sites of the body through the bloodstream. This is called active tuberculosis.

If an infected person is healthy, the initial tuberculosis infection is controlled by the immune system. The tuberculosis bacilli may remain confined within the tubercles for years. This is called latent tuberculosis. Latent means dormant or sleeping.

About 90% of infected people heal completely after the initial infection. The tubercles calcify and the bacteria cannot break out again.

For about 10% of infected people, the bacilli inside the tubercles become active sometime later in life when their immune system becomes weak. This is known as active tuberculosis.



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## Symptoms

Active tuberculosis spreads from alveoli through the bloodstream or lymphatic system. It may invade other areas in the body, such as the skin, kidneys, bones, reproductive system, or urinary system.

At the new sites, the body's immune system kill many bacilli, but immune cells and local tissue die as well. The dead cells form masses called granulomas, where bacilli can survive but not grow.

The early symptoms of active tuberculosis include:

- weight loss
- fever
- night sweats
- loss of appetite

Some patients may have little or no symptoms with TB.

As more lung tissue is destroyed and granulomas expand, cavities develop in the lungs, and sometimes expand into larger lung airways. This allows large numbers of bacilli to spread when the patient coughs.

As granulomas grow in the lungs, they may cause more coughing and shortness of breath as they destroy lung tissue.

Granulomas can also eat away at blood vessels, causing bleeding in the lungs, which could result in bloody sputum.

Symptoms of tuberculosis involving areas other than the lungs vary, depending on the organ affected. For example, when tuberculosis infects the spine, it can cause severe back pain or back deformities.

## Diagnosis

Latent tuberculosis or initial infection can be diagnosed with a skin test called a *Mantoux* test. This test can identify most people infected with tubercle bacilli 6-8 weeks after initial exposure.

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A substance called *PPD* is injected under the skin in the forearm and examined 48-72 hours later. If a red welt forms around the injection site, the person may be infected with *M. tuberculosis*, but the disease is not necessarily active.

A blood test known as QuantiFERON® -TB can also show if a patient has been exposed or is infected with *M. tuberculosis*

To diagnose active tuberculosis, a doctor relies on symptoms, the patient's history of exposure to TB, and x-rays that may show evidence of TB infection, usually in the form of cavities or lesions in the lungs.

The doctor will also take sputum and other samples to be examined by a pathologist. It is important to determine the type of tuberculosis bacteria involved in order to prescribe the most effective medication.

## **Treatment**

If not treated, active tuberculosis can be fatal, killing up to 60% of patients.

When treated, a cure can be achieved in 90% of all cases.

Successful treatment of tuberculosis depends on cooperation between the patient and doctor. Patient education is essential, and many doctors prefer to hospitalize the patient in order to observe him or her during treatment.

The treatment consists of taking more than one medication for a duration of months!

People who have been treated for at least two weeks are usually not contagious anymore.

Patients who do not take their medications as often and as long as prescribed, give the bacteria a chance to become resistant to the treatment. This is why it is VERY important to follow doctor's instructions.

## **Prevention**

As with most infectious diseases, it is better to prevent the disease than to treat it. Tuberculosis is very preventable.

Adequate ventilation and improving crowded conditions are essential in decreasing the spread of tuberculosis.

If infected people cover their mouth and nose when coughing or sneezing, the spread of TB can also be prevented.

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Identifying infected people early and treating them with medications is one of the most effective ways to prevent TB from spreading.

The drug *INH* can prevent TB and should be given to people

- who have latent tuberculosis
- are in close contact with infected patients
- have been in countries where tuberculosis is common
- are at risk of getting infected with tuberculosis

## **Vaccines**

The tuberculosis vaccine is called *BCG*. *BCG* prevents the spread of *M. tuberculosis* within the body, but does not prevent initial infection. It is recommended for infants in parts of the world where TB is common.

The vaccine *BCG* is not recommended for general use in the United States.

## **Summary**

Tuberculosis is a bacterial infection that can be fatal. The body's immune system can usually fight the infection and confine it successfully.

When the immune system is weak, confined tuberculosis bacteria can become active and spread to other parts of the body. This is active tuberculosis.

Thanks to advances in medicine, treatment is available to treat active TB. It is very important for the patient to follow the prescribed treatment.

Tuberculosis can be prevented through good hygiene, including good ventilation and covering the mouth when coughing.

A vaccine is available for some infants and is recommended for those who live in parts of the world with high occurrence of tuberculosis.

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