Primer on Tuberculosis (TB) in the United States

The purpose of this primer is to provide students who have no prior background in TB research or clinical care with basic knowledge that they may find helpful when using the TB materials in Masters of Public Health core courses.

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Introduction
TB has been present in humans since antiquity. Samples dating from 2400 BCE showed signs of TB in the spinal column of an Egyptian mummy.\(^1\) In ancient Greece, Hippocrates (460–370 BCE) called phthisis, or TB, the most widespread disease of the time and characterized it as almost always fatal.\(^2\)

For centuries, Europeans treated consumption, as they commonly called TB, with bed rest and a nourishing diet. Fresh mountain air was added to the prescription in the 19th century, and the preferred treatment in Europe and America became the sanatorium, a group residence in isolated, higher-altitude settings designed to provide TB patients comfortable rest in the fresh air. Sanatoria also isolated patients from the general population and thus reduced transmission. The most important advance in TB treatment came in the mid 20th century when the drug streptomycin was proven effective against TB. Several other anti-TB drugs followed in quick succession.

What is TB? TB is a disease caused by a type of bacteria called *Mycobacterium tuberculosis*, which usually attack the lungs. However, TB bacteria can proliferate in any part of the body such as the kidneys, spine, and brain. If not treated properly, TB disease can be fatal, and was once the leading cause of death in the United States.

Why is TB a problem today? In the mid 20th century, publicly funded TB programs made effective TB treatment widely available in the United States. As TB rates declined steadily over several decades, many TB programs were seen as unnecessary and were de-funded.

However, the United States experienced a dramatic resurgence of TB from 1985 to 1992, due to a combination of social and biological factors. Social factors included a long-term rise in urban poverty, increased immigration from countries where TB is endemic, and housing shortages in some cities. Outbreaks of TB in shelters, hospitals, and prisons revealed that infection-control systems in congregate facilities were inadequate. The 1980s also saw a rise in substance use in major US cities, and injection drug and crack cocaine users were disproportionately affected by the new surge in TB. Most important, the emergent epidemic of HIV/AIDS created a national pool of immunocompromised individuals uniquely vulnerable to TB disease. Biologically, TB bacteria evolved into deadly single- and multidrug resistant (MDR) strains. In the midst of the resurgence of TB was a frightening subepidemic of MDR TB, stemming in large part from widespread noncompletion of treatment. Inadequate prescribing practices of physicians also played a role in emergence of MDR TB.

Large increases in resources for TB control programs and the adoption of a national strategic plan to eliminate TB succeeded in decreasing TB rates in the United States. In 2007, the number of annually reported cases had declined by 50% since 1992. However, the 2007 case rate of 4.4\(^3\) is far from the Healthy People 2010 goal, a case rate of 1.\(^4\) The persistence of MDR TB and the emergence of even more dangerous, extensively drug resistant TB (XDR TB) added to the still-urgent challenge of TB control in the United States.
TB is a neglected disease of low economic priority in both developed and developing countries. Complacency and delayed arrival of inadequate funds for TB control in the past decade continues to be reflected and to affect the prevalence of TB disease in the United States and globally.

How is TB spread? TB is spread through the air from person to person. The bacteria are expelled into the air when a person with active TB disease of the lungs or throat coughs or sneezes. People nearby may breathe in these bacteria and become infected.

When a person breathes in TB bacteria, the bacteria can settle in their lungs and begin to grow. From there, these pathogens can move through the blood to other parts of the body, such as the kidneys, spine, and brain. TB in the lungs or throat can be infectious, thereby spreading to other people. TB in other parts of the body, such as the kidneys or spine, is usually not infectious. People with active TB disease are most likely to spread it to everyday contacts, including family members, friends, and coworkers.

What is active TB disease? TB bacteria become active if the immune system cannot stop them from growing. The active bacteria begin to multiply in the body and cause active TB disease. The bacteria attack the body and destroy tissue. If this occurs in the lungs, the bacteria can create holes in the lung. Some people develop active TB disease soon after becoming infected, before their immune system can respond and fight the TB bacteria. Other people may get sick with TB disease at a later time, when their immune system becomes weakened.

How is active TB disease treated? Active TB disease can almost always be cured with a multidrug regimen, taken as instructed by a medical provider. Multidrug regimens are necessary to avoid the development of drug-resistant strains of TB. Active TB disease of the lungs or throat can be infectious, usually requiring those with the disease to stay home from work or school and avoid close contact with others so that TB bacteria are not spread to other people. After taking medication for a few weeks, those with active TB will feel better and may no longer be infectious to others.

What is directly observed therapy (DOT)? DOT entails having TB patients take their medications in the presence of a health care provider, who documents that appropriate doses are taken at appropriate times. DOT providers meet patients in health care settings or at home, work, or other convenient locations. DOT is the preferred method of ensuring completion of treatment for TB in the United States and internationally.

What is latent TB infection (LTBI)? Most people who breathe in TB bacteria and become infected do not become ill immediately, because the body is able to contain the bacteria and stop it from growing. The inactive bacteria remain in the body with the potential to become activated, even many years later. This condition is called LTBI.

People with LTBI:

- Have no symptoms
• Do not feel sick
• Cannot spread TB to others
• Usually have a positive tuberculin skin test (TST) reaction
• Can develop active TB disease if they do not receive treatment for LTBI

Most people who have LTBI never develop active TB disease. In these people, the TB bacteria remain inactive for a lifetime without causing disease. But the bacteria can become active and cause TB disease in others, especially people whose immune system is weakened due to other diseases, such as HIV; immunosuppressant medical treatments; or life style factors, such as malnutrition or excessive alcohol use.

What tests are available for TB Infection?

• The TB skin test (TST)

The TST detects TB infection. It can be administered in a doctor's office, public health departments, or outside traditional health care settings. A trained health care worker injects a small amount of testing fluid, called tuberculin or purified protein derivative (PPD), just under the skin on the underside of the patient’s forearm. After 2 or 3 days, the patient returns to have the health care worker assess or "read" the test. The health care worker looks for raised swelling, or induration, at the site of the injection, caused by an acquired immune reaction to the TB protein and indicating a possible TB infection. If an individual is recently exposed to active TB disease, the TST should be repeated 8 to 12 weeks after the exposure, because it can take several weeks after infection for the immune reaction to develop. If a second TST is negative, TB infection can probably be ruled out.

Interferon Gamma Release Assays (IGRAs)

Interferon Gamma Release Assays (IGRAs) are blood-based tests used to determine if a person is infected with TB bacteria by measuring immune response to the bacteria. Unlike the TST, which requires that a person return to a trained health care provider to have the test result determined, use of an IGRA only requires one health care visit. Two commercial forms of the test, the T-SPOT®.TB and Quantiferon-TB Gold®, are approved for use in the US.

What if a person has a positive test for TB?

If a person has a positive reaction to the TST or IGRA, other tests may be done to rule out active TB disease. These tests usually include a chest X-ray and a test of the phlegm the patient coughs up. Because the TB bacteria may be found somewhere other than a person’s lungs, blood, urine, and other tests may be ordered. Patients determined to have active TB disease will be prescribed TB medications and will be followed by their health department.

What is the bacille Calmette-Guerin (BCG) vaccine? BCG is a vaccine for TB. This vaccine is not widely used in the United States, but it is sometimes given to infants and small children in other countries where TB is common. BCG vaccine does not provide lifelong protection from TB. Also, the vaccine may cause a positive reaction to the TST and thus confound diagnosis of LTBI. The IGRA test results are not affected BCG vaccine.
**What is MDR TB?** TB bacteria may become resistant to a particular medication if it is not taken as prescribed. When resistance occurs, prescribed treatment is no longer effective against TB disease. Sometimes the bacteria become resistant to 2 or more of the most important medicines; this is called multidrug resistant TB (MDR TB) and it is a very serious problem. People with MDR TB disease must be treated with complex regimens of medications.

**What is XDR TB?**
Extensively drug-resistant tuberculosis (XDR TB) is a relatively rare type of MDR TB. It is resistant to almost all drugs used to treat TB. Because XDR TB is resistant to the most powerful TB drugs, patients with XDR TB have few treatment options and often have worse treatment outcomes.

Sources

**Works Cited**


Please refer to the following CDC website for more information on TB: http://www.cdc.gov/tb/pubs/TBfactsheets.htm