CDC FACT SHEET

TB Drug Resistance in the U.S.

Tuberculosis (TB) is a serious disease caused by bacteria that are spread from person to person through the air. TB usually affects the lungs, but it can also affect other parts of the body, such as the brain, the kidneys, or the spine. In most cases, TB is treatable and curable; however, TB can be deadly without proper treatment.

TB bacteria can become resistant to the drugs used for treatment. When this occurs, treatment is often still possible, but it is complex, long, challenging, and expensive. Treatment can disrupt lives and have serious, potentially life-threatening side effects.

Rates of drug-resistant TB remain relatively low in the United States, though nearly half a million cases of multidrug-resistant TB are estimated to occur globally each year.[1] These cases underscore the need for ongoing vigilance and action, especially given the ease with which TB can spread through international travel and migration.

The Centers for Disease Control and Prevention works with state and local health departments and other health care providers to prevent the spread of TB, track drug-resistant cases, assist with diagnosis as needed, and help ensure that patients with drug-resistant TB receive effective treatment and care.

Causes of TB Drug Resistance

Drug-resistant TB can occur when the drugs used to treat TB are not used as prescribed. This may happen when:

- A patient misses doses or does not complete the full course of treatment
- A health care provider prescribes the wrong treatment, wrong dose, or wrong length of time for taking the drugs
- Effective drugs are not available
- Drugs are of poor quality

Individuals with drug-resistant TB disease can also transmit the resistant strain of the disease directly to others.

Snapshot: TB in the United States

Latent TB Infection	TB Disease	Multidrug-Resistant TB (MDR TB)
11.2 million people[2]	**9,582 cases**[3]	**95 cases**[3]
About 4% of the total U.S. population; approximately 5-10% of those with latent TB infection will develop TB disease at some point.	*These individuals are sick, with potential to transmit infection to others; without proper diagnosis or treatment, TB can be fatal.*	*About 1.4% of those with TB disease have MDR TB.*

National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
Centers for Disease Control and Prevention

DECEMBER 2014

Multidrug-Resistant TB (MDR TB)

MDR TB is a type of TB that is resistant to at least two of the best and most important anti-TB drugs: isoniazid and rifampin. These two drugs are considered first-line drugs and are recommended for treatment of all individuals with drug-susceptible TB disease (i.e., cases that are not drug-resistant).

While MDR TB is often curable, treatment is complex, requiring expert management and frequent monitoring. In comparison with drug-susceptible TB, which takes about six to nine months to treat, recommended treatment for MDR TB lasts 18 to 24 months or longer. MDR TB also requires the use of second-line medicines that are not as effective as the first-line medicines commonly prescribed to treat TB. The second-line medicines may also produce side effects that are difficult to tolerate. Close monitoring of patients while taking these drugs is critical, because the medications can lead to other serious health problems, such as damage to the kidneys, liver, or heart; loss of vision or hearing; and changes in behavior or mood (including depression or psychosis).

MDR TB is relatively rare in the United States. The proportion of U.S. TB cases that are MDR TB has remained relatively stable at approximately 1 to 2 percent in recent years. Among TB cases with drug-susceptibility testing completed, MDR TB accounted for 1.4 percent (95 cases) in 2013.[3]

Drug-Resistant TB

- **Multidrug-Resistant TB (MDR TB):** TB that is resistant to at least two of the best and most important anti-TB drugs (isoniazid and rifampin). While treatment is complicated, MDR TB is often curable.
- **Extensively Drug-Resistant TB (XDR TB):** TB that is resistant to isoniazid and rifampin among first-line drugs, resistant to any fluoroquinolone and at least one second-line injectable drugs. Treatment options are very limited and outcomes are often worse.

Globally, it is estimated that approximately one in 30 new TB cases (3.5 percent) and one in five previously treated cases (20.5 percent) are MDR TB.[1] India, China, and the Russian Federation account for more than half of the world's total cases of MDR TB, but the highest proportion of cases that are MDR TB occur in Eastern Europe and Central Asia.

The majority of U.S. MDR TB cases occur among foreign-born individuals (89 percent in 2013).[3] Most of these individuals were likely infected prior to their arrival in the United States, reflecting the heavy burden of TB outside this country. CDC is collaborating with other national and international public health organizations to improve TB screening and treatment of immigrants and refugees from countries with high rates of disease prior to entry in the U.S.

Extensively Drug-Resistant TB (XDR TB)

XDR TB is a rare type of multidrug-resistant tuberculosis. It is resistant to isoniazid and rifampin, and to second-line treatments including any one of the fluoroquinolones and at least one of three injectable drugs (amikacin, kanamycin, or capreomycin).

XDR TB can be treated and cured, but treatment options are less effective and have serious side effects. Additionally, XDR TB is more likely to lead to death.

XDR TB remains very rare in the United States; only four cases were reported in 2013.[3] Globally, however, XDR TB presents the greatest threat to TB control. The World Health Organization (WHO) reported that 100 countries worldwide had at least one case of XDR TB by the end of 2013, and an estimated 9 percent of MDR TB cases worldwide are XDR TB.[1]

The Financial Toll of Drug Resistance

Treatment for drug-resistant TB is very expensive. A recent CDC study found that direct costs for treatment (including drugs, diagnostics, case management, hospitalization) of MDR TB averaged $134,000 per case (in 2010 dollars), compared with $17,000 to treat drug-susceptible TB.[4] When including the productivity losses faced by patients while undergoing treatment, each case cost an average of $260,000 to treat.

The average direct cost of treatment for a person in the U.S. with XDR TB was even higher, at $430,000.[4] When including productivity losses, the average cost increased to $554,000.

TB Drug Shortages

Shortages of drugs used to treat TB have been reported over the past several years and are of particular concern. Until recently, these shortages primarily involved second-line TB drugs, which are critical for treating drug-resistant cases. In a 2010 survey, 81 percent of health departments with MDR TB cases reported difficulty obtaining these second-line treatments.[5] However, in recent years, isoniazid, a first line drug used in the treatment of TB disease and latent TB infection, was also in short supply. [6]

Drug shortages put patients and communities at greater risk for illness and disease transmission, and can further the development of drug resistance. When drugs are unavailable, fewer treatment options exist for patients. They may be prescribed less effective drugs, which can cause more side effects or prolong treatment.

For example, in April 2011, shortages of two second-line drugs caused an eight-day delay in treatment of a father and infant who had MDR TB.[5] This prolonged the father's infectious period, increasing the risk of transmission to his family and to the community. While both were ultimately successfully treated, the delay particularly endangered the health of the infant, who could have faced severe brain damage or death.

Ongoing collaboration among CDC, the U.S. Food and Drug Administration, health departments, and the pharmaceutical industry is critical in order to ensure the availability of effective anti-TB drugs

TB Basics

- Not everyone infected with TB bacteria becomes sick. Most people who breathe in TB bacteria and become infected are able to fight the disease and stop the bacteria from growing. This is called **latent TB infection**. People with latent TB infection do not feel sick, do not have any symptoms, and cannot spread the bacteria to others.
- In some people, TB bacteria overwhelm the defenses of the immune system and begin to multiply, resulting in the progression from latent TB infection to **TB disease**. Without treatment, the bacteria continue to multiply and destroy the body's tissue. At this stage, TB bacteria may be spread to others.
- According to WHO, about one-third of the world's population has latent TB infection[7] and nine million people developed TB disease in 2013.[1]
- In the United States, cases of TB disease have been declining for more than 20 years (to fewer than 10,000 in 2013)[3], but more than 11 million people in this country are estimated to have latent TB infection with the potential to develop TB disease.[2] Asian Americans, blacks, and Hispanics are more affected by TB than whites. People living with HIV and people who are homeless are especially vulnerable to TB.
- Treatment for TB disease typically requires multiple medications that must be taken for 6 months or longer.

Preventing Drug-Resistant TB

The most effective way to combat drug-resistant TB is to prevent it from occurring in the first place. Both patients and health care providers have a role to play in this.

Patients should:

- Take all medications exactly as prescribed and finish the full course of treatment, even if they no longer feel sick
- Tell their health care provider if they are having trouble taking medications

Health care providers should:

- Consult with an expert if MDR TB is suspected or diagnosed
- Diagnose TB cases quickly and accurately, including detection of drug resistance
- Follow recommended treatment guidelines
- Monitor patients' responses to treatment
- Ensure therapy is completed

Directly observed therapy is the most effective way to ensure that a patient with TB disease is taking medication and to determine if the medication is properly treating the disease.

CDC is helping by:

- Conducting ongoing monitoring and surveillance to track drug-resistant cases
- Supporting state and local health departments with diagnosis and drug-susceptibility testing, as well as assisting with the development of treatment regimens for challenging cases
- Providing training and education materials and resources for state and local TB control programs and other health care providers
- Providing funding to all 50 states, 8 territories, and 10 major cities to support local TB elimination activities, such as ensuring patients finish their treatment and that individuals exposed to TB disease are evaluated

If you are a member of the news media and need more information, please visit **www.cdc.gov/nchhstp/Newsroom** or contact the News Media Line at CDC's National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention: 404-639-8895 or **NCHHSTPMediaTeam@cdc.gov**.

Key References

[1] WHO. Global Tuberculosis Report 2014. Available at: http://www.who.int/tb/publications/global_report/en. Published 2014. (Accessed December 3, 2014)
[2] Bennett DE, Courval JM, Onorato I, et al. Prevalence of Tuberculosis Infection in the United States Population: The National Health and Nutrition Examination Survey, 1999-2000. *Am J Respir Crit Care Med*. 2008 Feb 1;177(3):348-55.
[3] CDC. *Reported Tuberculosis in the United States, 2013*. Atlanta, GA: U.S. Department of Health and Human Services, CDC, Oct 2014. Available at www.cdc.gov/tb.
[4] Marks S, et al. Treatment Practices, Outcomes, and Costs of Multidrug Resistant and Extensively Drug Resistant Tuberculosis in the United States. *Emerg Infect Dis.* 2014; 20(5).
[5] CDC. Interruptions in Supplies of Second-Line Antituberculosis Drugs, United States, 2005-2012. *MMWR* 2013;62(02):23-26.
[6] CDC. Impact of a Shortage of First-Line Antituberculosis Medication on Tuberculosis Control – United States, 2012-2013. *MMWR* 2013;62(20);398-400.
[7] WHO. TB Key Facts Fact Sheet. Available at: http://www.who.int/mediacentre/factsheets/fs104/en. Published 2014. (Accessed December 3, 2014)