National Institutes of Health

Fact Sheet   *Tuberculosis*

Yesterday

- Tuberculosis (TB) is one of the oldest human diseases. Mummies from ancient Egypt show signs of tubercular decay, and TB was common in both ancient Greece and Imperial Rome.

- Nineteenth century artists and writers romanticized "consumption." Physicians identified TB by its hallmark symptoms: dry, persistent cough, bloody sputum, intermittent fevers, and flushed complexion. Emaciation often preceded a difficult death.

- In March 1882, the German physician Robert Koch announced his discovery that a microbe he called *Mycobacterium tuberculosis (Mtb)* causes TB. He also demonstrated that TB can be spread from person to person, carried by droplets expelled when an infected person coughs, sneezes, speaks, or laughs.

- There is an inexpensive and safe TB vaccine, but its effectiveness is limited. More than one billion people have been inoculated since the vaccine was introduced in 1908. It can prevent TB infection in the brain among children, but it is nearly useless in preventing adult pulmonary TB.

- Before antibiotics became an effective treatment for TB in the 1940s and 1950s, patients were quarantined in sanatoria, where treatment included plenty of fresh air, sleep, food, and exercise.

- Hopes were high that thanks to antibiotics, TB, like some infectious diseases of previous centuries, could be completely conquered.

Today

- A century ago, TB was a leading cause of death in the United States.

- TB disease and deaths in the United States declined steadily from the turn of the century due largely to the introduction of effective antibiotics and improvements in living conditions.

- From 1985-1992 case rates of TB in the United States unexpectedly increased.

- Reasons contributing to this increase include the HIV epidemic, cutbacks in public health infrastructure and treatment programs, increasing poverty, homelessness and drug abuse.

- Since 1992, a large influx of Federal funds and renewed emphasis on TB therapy, prevention and control, led again to declining TB case and death rates in the United States.

- Despite this progress, TB remains one of the leading causes of illness and death in the world. For 2004, the World Health Organization (WHO) reported an estimated 1.7 million deaths from TB, which includes TB death in people infected with HIV.

- Both the largest number of deaths and the greatest number of deaths per capita occurs in the WHO Africa region where HIV has led to rapid growth of the TB epidemic, and increases the likelihood of dying from TB.

- It is estimated that one-third of the world's population, approximately 1.86 billion people, is infected with *Mycobacterium tuberculosis,* and 16.2 million people currently have TB disease.

- The TB crisis is intensified by the emergence of drug-resistant forms of the pathogen.

- The long duration and associated side effects of standard TB drug treatment often result in patients not completing the full course of therapy. The result is the emergence of single- and multi-drug resistant TB (MDR-TB) strains. Drug-resistant TB may require up to two years of treatment (treatment length varies with pattern of drug resistance). This therapy usually includes the use of second-line drugs that are less effective, more toxic, and are expensive. In addition, drug resistant TB patients may remain infectious for long periods, thereby increasing the chance for transmitting resistant strains.

- A virtually untreatable form of MDR-TB, extensively drug resistant TB (XDR-TB) was first defined in 2006. Global incidence of XDR-TB is uncertain; the first standardized global data, covering 2000-2004, indicate that 20 percent of all TB cases are MDR and that of the MDR cases, 10 percent are XDR.

- The devastating global impact of tuberculosis makes it a high priority research area. NIH supports studies to better understand how *M. tuberculosis* infects and causes disease in humans and how the human immune system responds to it. This research will help to develop new tools to diagnose TB and to find better vaccines and new medicines against TB.

- Recent advances in TB research that may impact the TB pandemic include:

  Diagnostics
  – Potential new tests may speed the diagnosis of TB from 4 weeks to 2 days
  – Differences found in the DNA of *M. tuberculosis* and the bacterium used in the BCG vaccine may lead to a test to tell the difference between people who really have TB and those who are merely reacting to previous BCG vaccination
  – Characterization of antibodies and other components of the immune response may potentially identify people who are infected with *M. tuberculosis* and are at the highest risk of developing active disease

  Treatment
  – Development of promising new drug candidates, some of which are currently being tested in human clinical trials
  – Evaluation of shorter treatment regimens to make it easier for people to complete drug therapy
  – Inclusion of antibiotics that are already available for treatment of other infections and have been shown to act on *M. tuberculosis* may make therapy more potent and easier to tolerate

  Vaccines
  – Three new vaccine candidates are now in clinical trials and several more are being analyzed in animal studies

Tomorrow

- It is anticipated that priority NIH research will close resource and knowledge gaps in five critical areas, especially relative to MDR- and XDR-TB: therapies for drug-resistant TB that can be used in HIV positive and HIV negative patients; technologies to rapidly diagnose drug resistance among TB patients; the basic biology of the development and spread of drug-resistant strains of tuberculosis; the influence of HIV co-infection on development of drug-resistance; and the development of effective preventive strategies for TB and drug-resistant TB.

- Advances in these areas will vastly improve the arsenal of drugs, vaccines, and diagnostics needed to wage effective war against tuberculosis in all its forms.

Additional information about TB and NIH-supported TB research can be found at http://www3.niaid.nih.gov/healthscience/healthtopics/tuberculosis/default.htm