FACT SHEET

Influenza

NATIONAL INSTITUTES OF HEALTH

Yesterday

- Influenza is a serious and highly infectious respiratory disease. Historical records indicate that influenza epidemics have occurred among human populations for hundreds – if not thousands – of years.
- Global influenza pandemics occurred three times in the twentieth century alone: 1968, 1957, and the "Spanish Flu" of 1918-1919, which caused more than 500,000 deaths in the United States and 50 million deaths worldwide.
- Influenza viruses constantly circulate through the human population. Seasonal influenza epidemics in the Northern Hemisphere usually occur in winter months.
- The genes that encode influenza surface proteins can undergo small changes—a process called *antigenic drift*—which enables the virus to evade immune responses generated to prior exposure or vaccination. Seasonal antigenic drift is the reason influenza vaccines must be updated annually.
- Influenza can also change dramatically through a process called *antigenic shift*. Because influenza also infects other species such as pigs and birds, new viruses can evolve when animal and human viruses mix genes or when an animal virus infects a human. These viruses are usually able to evade the human immune response because there is little to no immunity.
- Occasionally, through the processes of antigenic shift and antigenic drift, an animal virus is able to gain the ability to spread easily from person-to-person, which ultimately can result in a pandemic.

Today

- Influenza remains a major threat to public health. Recent studies show that in a typical influenza season, 5 to 20 percent of the United States population falls ill, more than 200,000 are hospitalized, and 36,000 die. The most severe outcomes occur in people 65 and older, very young children, and those with underlying health conditions. Globally there are 3 to 5 million cases of severe influenza and up to 500,000 die as a result.
- Recently, a flu strain called H5N1 that originated in birds began infecting people, mostly in Southeast Asia and Africa, with a mortality rate of approximately 60%. As of February 2011 there were 519 laboratory confirmed human cases and 306 deaths. The H5N1 virus does not spread easily from person-to-person, but public health officials are concerned that it could develop this ability and spark a fast-moving global pandemic. Due to its high lethality and virulence, H5N1 is considered a major pandemic threat.

Emerging Pandemic Strains

- In April 2009, a new influenza virus emerged in North America, sparking the first pandemic of the 21st century. The novel 2009 H1N1 virus was highly transmissible and quickly became the predominantly circulating strain around the world during the 2009-2010 flu season. The virus was unrelated to previously circulating seasonal influenza strains but had genetic similarity to H1N1 flu strains in pigs, birds, and humans.
- In the United States, the Centers for Disease Control and Prevention (CDC) estimated that from April 2009 to April 2010 there were 61 million cases, 274,000 hospitalizations, and 12,000 deaths attributed to the virus. Unlike seasonal influenza, most deaths occurred in those 18-64 years of age.
- The NIH spearheaded scientific and clinical research to develop and test drugs, vaccines, and diagnostics to combat the virus. The NIH drew upon its established research infrastructure across the country to perform this task.
- In April 2007, NIH established six Centers of Excellence for Influenza Research and Surveillance (CEIRS) to expand the National Institute of Allergy and Infectious Diseases (NIAID) influenza research and surveillance program both in the U.S. and internationally. CEIRS scientists were the first to describe the H1N1 virus origin, genetic evolution, pathogenesis and transmission in animals, and susceptibility to antiviral drugs. They predicted that 2009 H1N1 influenza would

be the dominant flu virus circulating during the 2009-2010 flu season.

- NIH, CDC, and the U.S. Food and Drug Administration (FDA) worked together to characterize the virus, identify a candidate vaccine strain, and expedite manufacturing. Clinical trials were conducted through the NIH Vaccine and Treatment Evaluation Units to test vaccine safety and effectiveness. Data from the trials helped to develop vaccination recommendations and assisted in the FDA approval of the vaccine in September 2009 for use in the United States.

Influenza Research at NIH

Vaccines

- FluMist®, a needle-free addition to the vaccine arsenal, was developed in part by NIH researchers and uses a weakened form of the virus delivered as a nasal spray.
- NIH is supporting developmental research and clinical trials to evaluate the efficacy of vaccines against influenza strains that have pandemic potential, including H9N2, H5N1, H7N3, H2N2 and H6N1.
- Other studies supported by NIH address the impact of using adjuvants, substances that when added to a vaccine can help increase the immune response. Results from a Phase I clinical trial of a candidate vaccine against H9N2 influenza—an avian virus that causes human deaths—indicate that addition of adjuvants can reduce the number of vaccine doses required to protect against infection. This strategy is now being assessed for vaccines against the H5N1 virus.
- A potential countermeasure against influenza would be a "universal" vaccine that would be effective against multiple virus types. An effective universal vaccine will elicit protection against viruses currently circulating as well as new viruses that may emerge. Using a novel gene-based vaccine approach, NIH scientists have generated antibodies in animal models that responded to a broad array of influenza viruses. Human safety and immunogenicity clinical trials testing this concept are underway.

Antivirals

- As a counterpart to vaccines, antivirals are used for the prevention and therapy of viral infections. Effective use of antivirals depends on the identification of the virus and its susceptibility to the drug.

  NIH continues to support the development and clinical evaluation of antivirals against influenza. For example, NIH supported significant preclinical and clinical development of the antivirals laninamivir and fludase, which are currently in Phase III and II trials, respectively, due to support from NIH. In September 2010, Japan approved laninamivir for treatment of influenza infection.

Diagnostics and Other Resources

- NIH-supported researchers have developed several new diagnostic technologies/tools that rapidly detect influenza antibodies in human samples.
- More than 5,000 influenza viruses from different strains have been sequenced through the NIH Influenza Genome Sequencing Project, launched in 2004.

NIH established the South East Asia Infectious Disease Clinical Research Network (SEAICRN) in 2005 in collaboration with Indonesia, Thailand, the United Kingdom, and Vietnam. The goal is to improve patient care by advancing scientific understanding and clinical treatment of human influenza and emerging infectious diseases.

Tomorrow

- NIH maintains a robust research program designed to encourage vaccine, antiviral drug, and diagnostics development and to enhance our understanding of influenza viruses and protective immune mechanisms. NIH supports several on-going projects to accelerate these efforts.
- NIH continues to improve the methods used to manufacture large numbers of vaccine doses rapidly, including using cell culture methods.
- NIH initiated population-based studies to model the effects of public health interventions, such as school closings and distribution of vaccine to specific groups, on the spread of a pandemic flu. These studies may provide insight into how best to reduce the damage that a pandemic will inevitably cause.

Contact Information:

National Institute of Allergy and Infectious Diseases
http://www.niaid.nih.gov/topics/flu/pages/default.aspx