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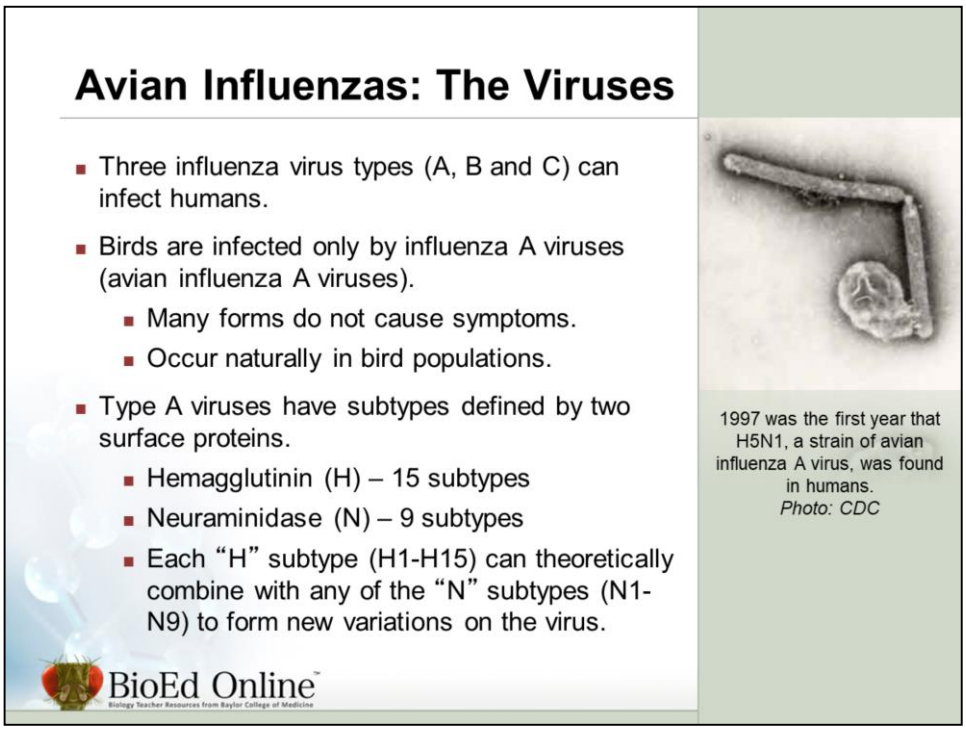

Avian Influenzas: The Viruses

Influenzas, commonly referred to as "the flu," are contagious diseases caused by influenza viruses, types A, B, or C. Influenza Type A viruses, with varying degrees of virulence, can infect humans, birds, pigs, horses, and other animals. Type B influenza viruses normally infect only humans, but have not caused pandemics (global outbreaks of disease). Type C influenza viruses cause only mild illness in humans.

Influenza A viruses are named by the combination of two proteins, Hemagglutinin (H) and Neuraminidase (N), located on the surface of the virus. There are 15 subtypes of HA and 9 subtypes of NA, presenting the possibility of unique 135 combinations.

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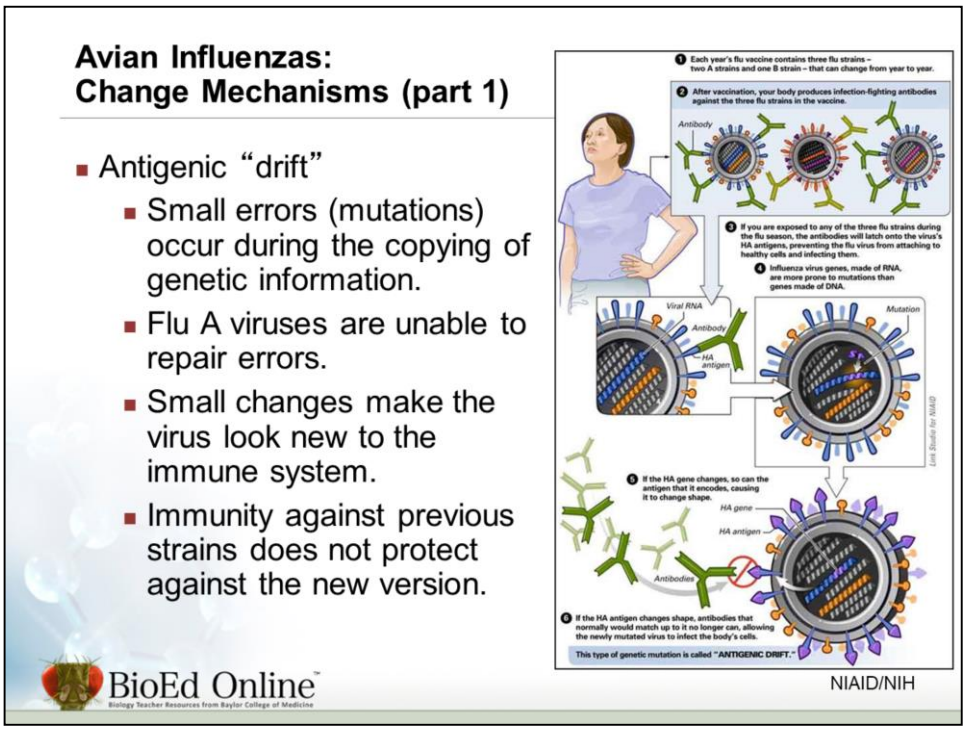

Avian Influenzas: Ability to Change

Viruses are constantly evolving, making them well adapted to escape the defenses of their hosts. Viruses, such as influenza A, are unable to "proofread" and repair errors that occur while their genetic information is being copied. As a result, these pinpoint changes (mutations) become permanent and may lead to new variants, or strains, of the virus. This process is referred to as antigenic "drift." Agents, such as disease-causing microorganisms, that activate the immune system are called "antigens." Thus, antigenic drift implies a slight change in the composition of a virus subtype that affects how it is recognized by the immune system. Usually, slight antigenic drifts are sufficient to allow the virus to evade immune system defenses tailored to fight another variant of the virus.

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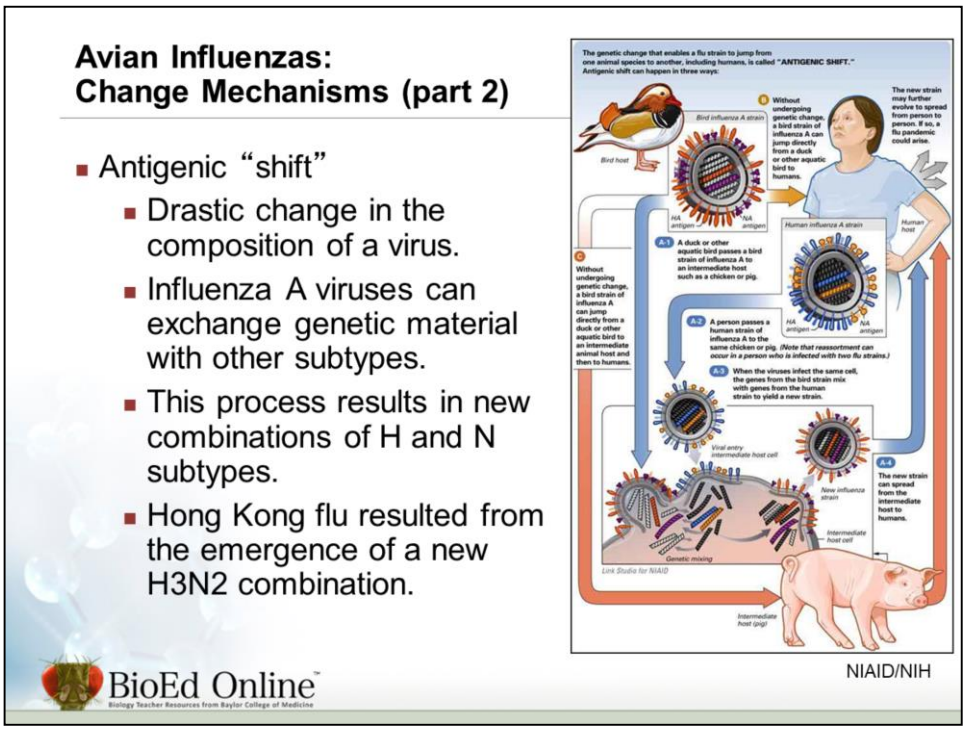

Avian Influenzas: Ability to Change

Occasionally, major changes occur in the genetic structure of the influenza virus that drastically affect the way it interacts with the immune system and causes disease. These changes, called antigenic "shifts," result in new combinations of influenza A virus subtypes. One way that antigenic shifts can occur is if a common human strain of influenza A virus and an avian influenza virus both infect the same animal. Viruses, in general, easily swap genetic material. In the case of flu, such a reassortment could result in a new strain, different from both original strains. Pigs are susceptible to both bird and mammalian viruses, and thus serve as excellent "mixing vessels" for recombining genetic material from related viruses. Humans living near poultry and pigs have long been thought to be at risk for exposure to such new strains. Antigenic shift was responsible for the emergence of the Hong Kong flu in 1969. This flu was caused by H3N2, which arose when the human H2N2 subtype reassorted with genes from bird viruses that contained the H3 subtype.

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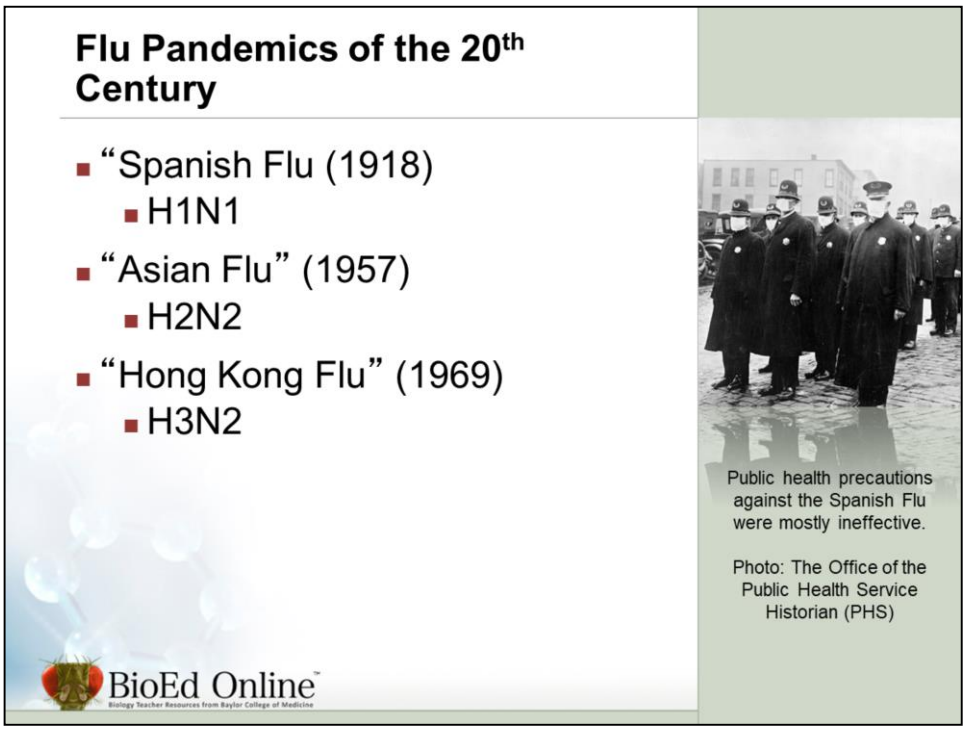

Pandemics of the 20th Century

Pandemics occur when a simultaneous, widespread outbreak of influenza A virus occurs worldwide, regardless of sanitation, hygiene, or standards of health. Pandemics are possible when a specific, highly virulent strain of flu undergoes a genetic change that allows it to circulate within a population that has no immunity to the novel strain. "Spanish flu" of 1918 was by far the most devastating, killing between 20 and 40 million people. The Asian flu killed 100,000 people in 1957, while 700,000 people died in the 1969 Hong Kong flu pandemic. Health officials are concerned that a number of factors have lined up to set the stage for the first worldwide influenza outbreak of the 21st Century.

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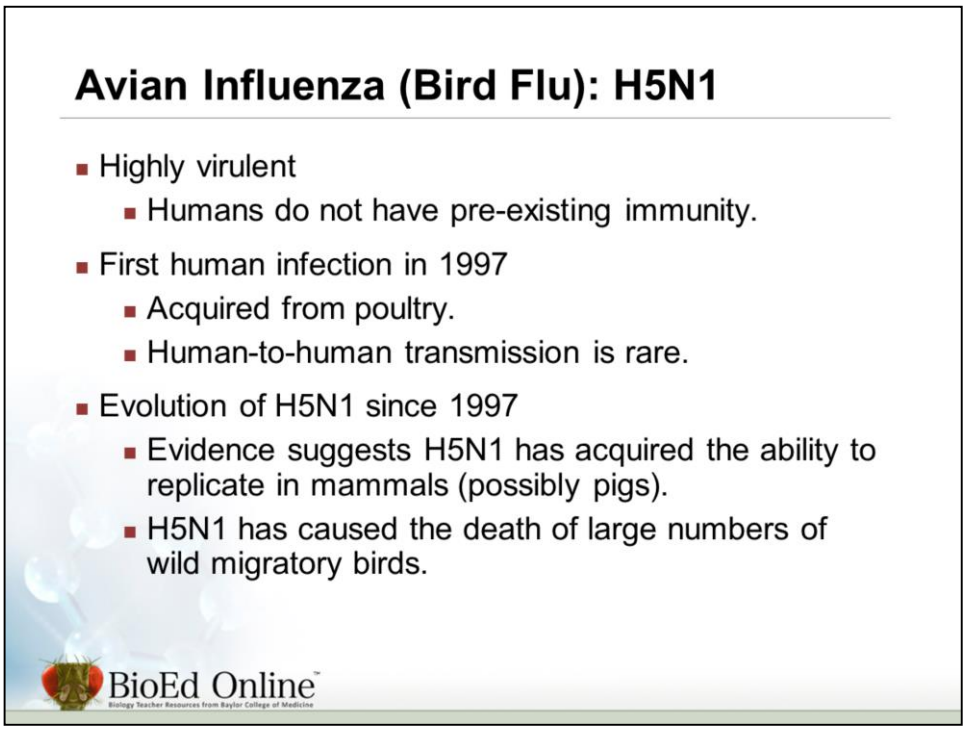
Image Reference

Policemen in Seattle wearing masks made by the Red Cross, during the influenza epidemic. December 1918. Retrieved 5-1-2013 from http://commons.wikimedia.org/wiki/File:165-WW-269B-25-police-l.jpg.



Avian Influenza: H5N1

H5N1 is a variant of influenza A virus that usually does not infect humans. Thus, most humans do not have pre-existing immunity to this strain. Beginning in 1997, more than 600 cases of human infection by bird influenza virus H5N1 have been documented. It is believed that most cases of H5N1 were spread by direct contact with infected poultry, and to date, the virus has not acquired a mechanism for efficient transfer from human to human.

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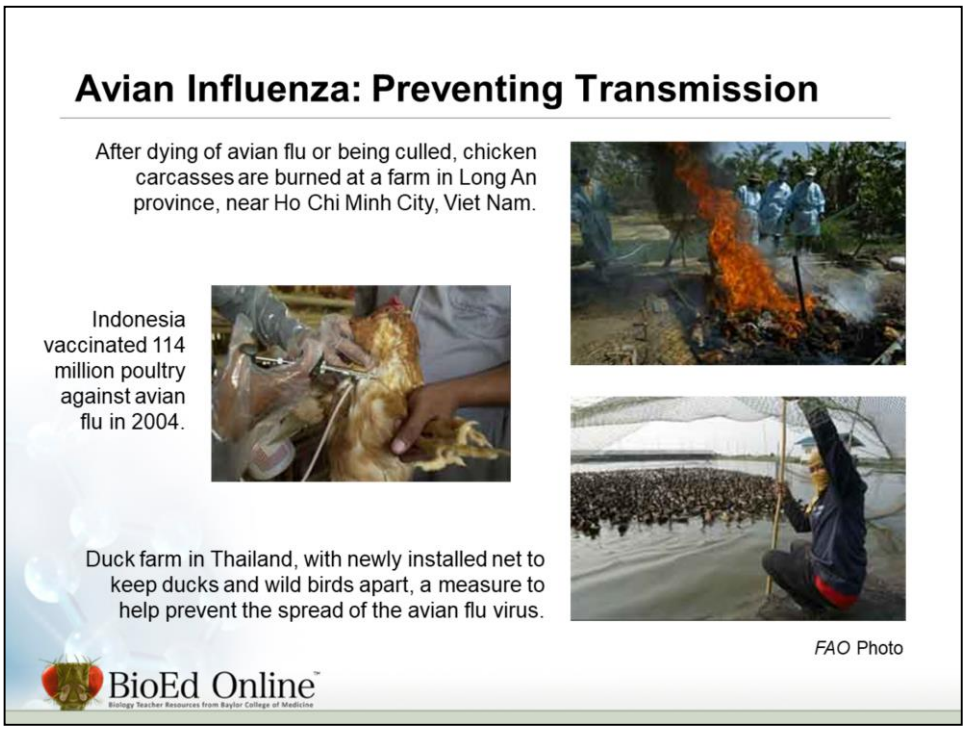

Avian Influenza: Preventing Transmission

Measures to keep avian influenza (bird flu) from spreading among animal populations have included: destruction of carcasses of animals that have died from H5N1 infection; vaccination of massive numbers of domestic birds against the current strain of H5N1; and efforts to minimize contact between domestic birds and wild birds, which are potential carriers of avian influenza.

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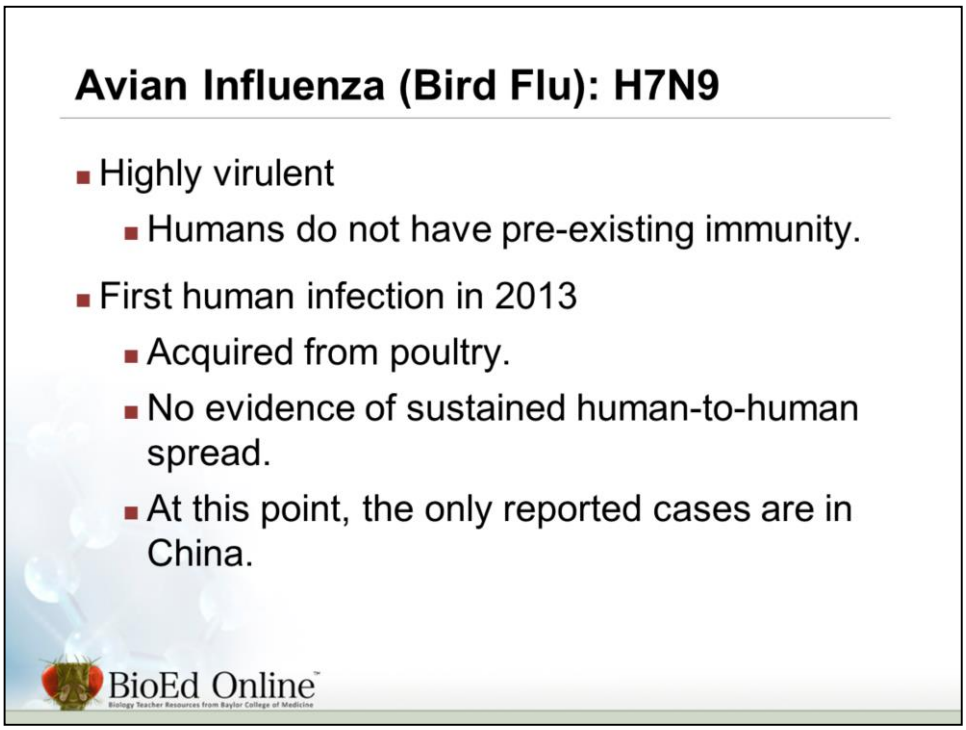

Avian Influenza: H7N9

The H7N9 subtype of influenza has emerged, and numerous cases have been reported in China. Although avian influenzas can be transmitted between humans (during unprotected, close, prolonged contact between a caregiver and the patient), such spread is limited and considered "dead-end." A bird flu pandemic would require efficient, sustained human-to-human transmission. There is no current evidence that H7N9 is spreading in this manner.

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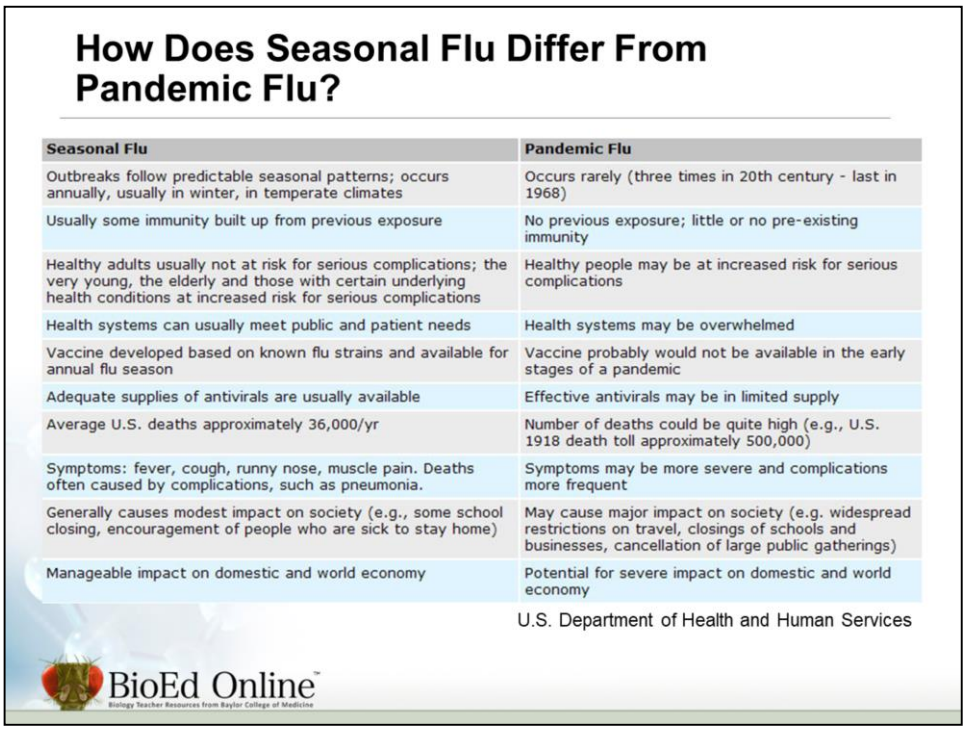

How Does Seasonal Flu Differ From Pandemic Flu?

Seasonal Flu	Pandemic Flu
Outbreaks follow predictable seasonal patterns; occurs annually, usually in winter, in temperate climates	Occurs rarely (three times in 20th century - last in 1968)
Usually some immunity built up from previous exposure	No previous exposure; little or no pre-existing immunity
Healthy adults usually not at risk for serious complications; the very young, the elderly and those with certain underlying health conditions at increased risk for serious complications	Healthy people may be at increased risk for serious complications
Health systems can usually meet public and patient needs	Health systems may be overwhelmed
Vaccine developed based on known flu strains and available for annual flu season	Vaccine probably would not be available in the early stages of a pandemic
Adequate supplies of antivirals are usually available	Effective antivirals may be in limited supply
Average U.S. deaths approximately 36,000/yr	Number of deaths could be quite high (e.g., U.S. 1918 death toll approximately 500,000)
Symptoms: fever, cough, runny nose, muscle pain. Deaths often caused by complications, such as pneumonia.	Symptoms may be more severe and complications more frequent
Generally causes modest impact on society (e.g., some school closing, encouragement of people who are sick to stay home)	May cause major impact on society (e.g. widespread restrictions on travel, closings of schools and businesses, cancellation of large public gatherings)
Manageable impact on domestic and world economy	Potential for severe impact on domestic and world economy

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Seasonal Flu vs. Pandemic Flu

Flu outbreaks usually are seasonal (occurring during the winter months) and involve variants of flu viruses to which most human populations already have been exposed. Thus, most individuals have some immunity to these strains. Even though seasonal flu outbreaks lead to 36,000 deaths on average each year, health care systems are able to handle the number of cases that occur within the general population.

Worldwide outbreaks of new influenza subtypes are rare, but lead to much higher rates of infection and death. Because these outbreaks affect large numbers of people around the world they are called “pandemics”. Rates of infection with new variants of flu, such as those that have caused previous pandemics, are much higher because most people have little or no pre-existing immunity. In addition, since the disease spreads easily and quickly, health care systems can be overwhelmed by the number of patients needing hospitalization.

Reference

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