Bird watch

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Bird influenza strains do not usually infect humans and generally reside in migratory waterfowl—until mutations occur.

In 1918, an influenza virus of avian origin raced through the U.S. with the strength of a class-5 hurricane, killing 675,000 Americans, most of them in the prime of life, over a period of just a few months. Around the globe, this pandemic flu ultimately sickened—and killed—millions, leaving its mark on everyone from soldiers in the trenches of World War I to their families back at home.

How did a bird flu virus infect humans at all, let alone kill so many so fast? And why are experts worried now about the current strain of bird flu circulating in Asia and Europe? To answer these questions, one has to understand the virology of the influenza virus.

Virus: Unlike the measles, chickenpox, and hepatitis viruses, influenza is constantly reinventing itself. Each time it makes a new copy of itself, it makes careless transcription errors, or mutations. The result is that each generation of influenza virus is slightly different from the one before. Why does this matter to us? Well, our immune systems rely on certain surface patterns to recognize and destroy viruses. As influenza keeps changing, it becomes less recognizable to our immune systems and thus more able to cause disease. So each year a new vaccine must be formulated to match the latest version of influenza.

Another way that influenza can make dramatic changes is by exchanging large chunks of genetic material with other types of influenza viruses. For instance, when a pig flu virus and a human flu virus simultaneously infect a pig (which is susceptible to both), they can exchange genes during reproduction, resulting in a new configuration that contains part pig and part human influenza. The pig part is totally unrecognized by the human immune system, so it can cause more widespread disease.

Mutations: Bird influenza strains do not usually infect humans and generally reside in migratory waterfowl, which can carry the virus without becoming sick. However, occasionally, through an exchange of genetic material (or, rarely, through a series of small mutations over time), a bird flu strain can gain the ability to infect humans. An initial case might occur when a human has close contact with a sick bird. Then if further mutations allow this virus to be transmitted from human to human—and if it causes severe disease in humans—the stage is set for pandemic influenza.

This is what happened in 1918, and this is what experts fear could happen with the current avian flu strain in Asia. First, this strain moved from migratory water birds to domestic poultry on farms near Asian waterways. Poultry in Asia are raised on small farms, in very close contact with humans, and are taken live to markets where they are sold. So the opportunities for birds to infect humans are greater in Asia than in the United States.

Already, the current avian flu virus has the ability to cause severe disease in humans. If the next mutations allow the virus to be easily spread from human to human, this virus could cause a major pandemic. But, alternatively, future mutations could weaken the virus—making it *less* likely to cause disease. The only certainty is that, given its propensity for sloppy reproduction and promiscuous exchange of genetic material, influenza will eventually cause another pandemic. Whether the current strain of avian flu will trigger the next pandemic, no one can say for sure.

Knowing all this, what can we expect and what can we do to prepare? First, we must anticipate and plan for the impacts of a flu pandemic. When a new strain of influenza hits a susceptible community, the result is a sudden and rapidly moving outbreak of disease. Some experts suggest that 10% to 20% of people might be unable to work at any one time. Sick people are likely to overwhelm the capacity of health-care facilities. Doctors and nurses will be affected by illness as well. Schools will likely need to close. Community services will operate at restricted capacity.

Community leaders need to work with health-care and public-health officials to anticipate and plan for shortages of caregivers, from first responders to home-health nurses to doctors. Citizens may need to receive basic training and protective equipment such as masks and gloves so they can help care for sick family members or neighbors.

Outbreak: If a new strain of flu is moving through a community, the best thing an individual can do is to stay home. A supply of food, a source of heat, and plenty of soap and tissues will likely be as important as any medical supplies. Depending on the timing of the flu outbreak in a community, it's possible that a vaccine against the new strain of flu will be available. However, it is likely to be in short supply and will be allocated first to groups at highest risk of ongoing exposure. Antiviral medications may be of some benefit, but will probably be used to treat people who require hospitalization for influenza. DHMC, many states, and a number of national societies, have strongly discouraged personal stockpiling of antiviral drugs. Such stockpiling now would make the drugs less available for those who may really need them, this season or during a pandemic.

Finally, it may be time to pressure our political leaders to help communities around the world—regardless of their political ideologies—prepare for the inevitable natural and biological disasters that lie ahead. Let's hope the recently released federal pandemic preparedness plan is a step in that direction.

In 1918, a bird influenza virus took the world completely by surprise. We don't have to let that happen again. ■

"Grand Rounds" covers a topic of interest to the Dartmouth medical faculty. Kirkland, an assistant professor of medicine (infectious disease), is a 1986 graduate of DMS.