

Swine Influenza A (H1N1 Virus): A Pandemic Disease

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ABSTRACT

Swine influenza (SI) is a respiratory disease of pigs caused by type A influenza that regularly causes pandemics. SI viruses do not normally infect humans; however, human infections with SI do occur, and cases of human-to-human spread of swine flu viruses have been documented. Swine influenza also called as swine flu, hog flu, and pig flu that refers to influenza is caused by those strains of influenza virus, called SI virus (SIV), that usually infect pigs endemically. As of 2009, these strains are all found in influenza C virus and subtypes of influenza A virus known as H1N1, H1N2, H3N1, H3N2, and H2N3. The viruses are 80–120 nm in diameter. The transmission of SIV from pigs to humans is not common and does not always cause human influenza, often only resulting in the production of antibodies in the blood. The meat of the animal poses no risk of transmitting the virus when properly cooked. If the transmission does cause human influenza, it is called zoonotic swine flu. People who work with pigs, especially people with intense exposures, are at an increased risk of catching swine flu. In the mid-20th century, the identification of influenza subtypes became possible; this allowed accurate diagnosis of transmission to humans. Since then, 50 confirmed transmissions have been recorded; rarely these strains of swine flu can pass from human to human. In humans, the symptoms of swine flu are similar to those of influenza and of influenza-like illness, namely, chills, fever, sore throat, muscle pains, severe headache, coughing, weakness, and general discomfort. Influenza A is a single-stranded RNA virus with eight different segments. When two viruses co-infect the same cell, new viruses can be produced that contain segments from both parental strains.

Introduction


Swine influenza (SI) is a virus disease that can cause epidemics of acute respiratory disease in pigs. The disease is due to viruses from the type A of the *Orthomyxoviridae* family, (there are three types in the *Orthomyxoviridae* family: A, B, and C). The etiology of SI is complex according to the high genetic variation of the causative viruses, mainly on the basis of two glycoproteins: hemagglutinin (H) and neuramidase (N). The nomenclature for virus designation

has been established by the World Health Organization (WHO) in 1980. The disease causes high morbidity but low mortality. It can also persist as an endemic infection and is a potential zoonosis.^[1-6]

The 2009 flu outbreak in humans, known as “swine flu,” is due to a new strain of influenza A virus subtype H1N1 that contains genes closely related to SI.^[7] The origin of this new strain is unknown. Influenza A virus subtype H1N1 is an epidemic of a new strain of influenza virus commonly referred to as “swine flu.” It is thought to be a mutation (“reassortment”) of four known strains of influenza A virus subtype H1N1: one endemic in humans, one endemic in birds, and two endemic in pigs (swine). The source of the outbreak in humans is still unknown, but cases were first discovered in the United States and soon after in Mexico, which had a surge of cases, many of them fatal.^[8]

H1N1 and H3N2 swine flu viruses are endemic among pig populations in the United States and something that the industry deals with routinely. Studies have shown that the swine flu H1N1 virus is common throughout pig populations worldwide, with 25% of animals showing antibody evidence of infection. In the United States, studies have shown that 30% of the pig population has antibody evidence of having had H1N1 infection. More specifically, 51% of pigs in the north-central United States have been shown to have antibody evidence of infection with the swine H1N1 virus.

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Human infections with swine flu H1N1 viruses are rare. There is currently no way to differentiate antibodies produced in response to flu vaccination in pigs from antibodies made in response to pig infections with swine H1N1 influenza. While H1N1 swine viruses have been known to circulate among pig populations since at least 1930, H3N2 influenza viruses did not begin circulating among US pigs until 1998. The H3N2 viruses initially were introduced to the pig population by humans. The current swine flu H3N2 viruses are closely related to human H3N2 viruses.

Swine flu outbreaks in pigs occur regularly, causing high levels of illness and low death rates. Swine influenza viruses may circulate among swine throughout the year, but most outbreaks occur during the late fall and winter months similar to outbreaks in humans. Swine flu occasionally infects people without causing large outbreaks. Like all influenza viruses, swine flu viruses change constantly. Pigs can be infected by bird and human influenza viruses as well as swine influenza viruses. When influenza viruses from different species infect pigs, the viruses can reassort (i.e., swap genes) and new viruses can emerge. That is what has happened with the recent cases of H1N1. This form of the H1N1 swine flu virus has never been seen before, and it is also causing illness among humans in many countries. It is a genetic mixture of viruses from pigs, birds, and people. Because it is a new virus, most people's immune systems do not know how to fight this H1N1 virus. So, many people are susceptible to becoming ill. A variant of H1N1 caused the flu pandemic of 1918.^[9-17]

Based on its genetic structure, the new virus is without question a type of swine influenza, derived originally from a strain that lived in pigs.^[18] This origin was largely used by mass media in the first days of the epidemic. Despite this origin, the current strain is now a human-to-human transmitted virus, requiring no contact with swine. WHO stated that no pigs in any country had been determined to have the illness, but farmers remain alert due to concerns that infected humans may pass the virus to their herds.^[19] On May 2, 2009, it was announced that a Canadian farm worker who had traveled to Mexico had transmitted the disease to a herd of pigs, showing that the disease can still move between species.^[20] Some authorities object to calling the flu outbreak "swine flu." US Agriculture Secretary Tom Vilsack expressed concerns that this would lead to the misconception that pork is unsafe for consumption.^[21] Centers for Disease Control and Prevention (CDC) now refers it as novel influenza A (H1N1).^[22] In the Netherlands, it was originally called "pig flu," but is now called "Mexican flu" by the national health institute and the media. South Korea and Israel briefly considered calling it the "Mexican virus."^[23] Currently, the South Korean press uses "SI," short for "swine influenza." Taiwan suggested the names "H1N1 flu" or "new flu," which most local media now use.^[24] The World Organization for Animal Health has proposed the name "North American influenza."^[25] The European Commission uses the term "novel flu virus." WHO announced they would refer to the new influenza virus as influenza A (H1N1) or "influenza A (H1N1) virus, human"^[26] as opposed to "swine flu," also to avoid suggestions that eating pork products carried a risk of infection.^[27,28]

The outbreak has also been called the "H1N1 influenza," "2009 H1N1 flu," or "swine-origin influenza." However, Seth Borenstein, writing for the Associated Press quoted several experts who objected to any name change at all [Figure 1].^[29-33]

The hemagglutinin (HA) and neuraminidase (NA) proteins are shown on the surface of the particle. The viral RNAs that make up the genome are shown as red coils inside the particle and are bound to ribonuclear proteins (RNPs). Influenza, commonly known as flu,

is an infectious disease of birds and mammals caused by an RNA virus of the family *Orthomyxoviridae* (the influenza viruses) [Figure 2].

Classification

Of the three genera of influenza viruses that cause human flu, two also cause influenza in pigs, with influenza virus A being common in pigs and influenza virus C being rare.^[39] Influenza virus B has not been reported in pigs. Within influenza virus A and influenza virus C, the strains found in pigs and humans are largely distinct, although due to reassortment, there have been transfers of genes among strains crossing swine, avian, and human species boundaries.

Influenza C

Influenza C viruses infect both humans and pigs, but do not infect birds.^[40] Transmission between pigs and humans have occurred in the past.^[41] For example, influenza C caused small outbreaks of a mild form of influenza amongst children in Japan and California.^[42] Due to its limited host range and the lack of genetic diversity in influenza C, this form of influenza does not cause pandemics in humans.^[43]

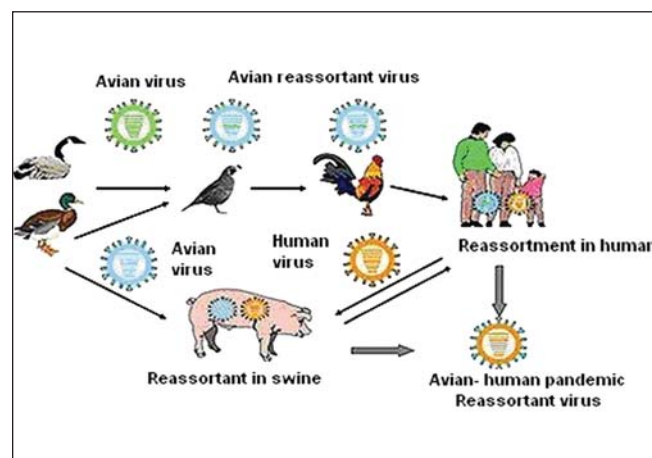


Figure 1: Generation of pandemic influenza strain

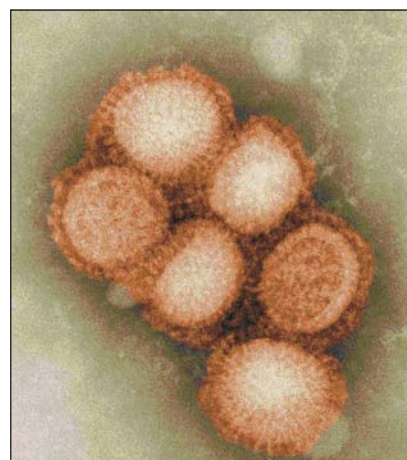


Figure 2: Preliminary negative stained transmission electron micrograph (TEM) depicted some of the ultra structural morphology of the A/CA/4/09 swine flu virus.^[36, 37,38]

Influenza A

Swine influenza is known to be caused by influenza A subtypes H1N1,⁴⁴ H1N2,⁴⁴ H3N1,⁴⁵ H3N2,⁴⁴ and H2N3.⁴⁶ In pigs, three influenza A virus subtypes (H1N1, H3N2, and H1N2) are the most common strains worldwide.⁴⁷ In the United States, the H1N1 subtype was exclusively prevalent among swine populations before 1998; however, since late August 1998, H3N2 subtypes have been isolated from pigs. As of 2004, H3N2 virus isolates in US swine and turkey stocks were triple reassortants, containing genes from human (HA, NA, and PB1), swine (NS, NP, and M), and avian (PB2 and PA) lineages [Figure 3].⁴⁸

Virus characteristics

The virus is a novel strain of influenza for which human populations have been neither vaccinated nor naturally immunized.⁴⁹ It was also determined that the strain contained genes from four different flu viruses: North American swine influenza; North American avian influenza; human influenza; and two swine influenza viruses typically found in Asia and Europe. Further analysis showed that several of the proteins of the virus are most similar to strains that cause mild symptoms in humans, leading some to suggest that the virus is unlikely to cause severe symptoms for most people.⁵⁰

History

Swine influenza was first proposed to be a disease related to human influenza during the 1918 flu pandemic, when pigs became sick at the same time as humans.⁵¹ The first identification of an influenza virus as a cause of disease in pigs occurred about 10 years later, in 1930. For the following 60 years, swine influenza strains were almost exclusively H1N1. Then, between 1997 and 2002, new strains of three different subtypes and five different genotypes emerged as causes of influenza among pigs in North America. In 1997–1998, H3N2 strains emerged. These strains, which include genes derived by reassortment from human, swine and avian viruses, have become a major cause of swine influenza in North America. Reassortment between H1N1 and H3N2 produced H1N2. In 1999 in Canada, a strain of H4N6 crossed the species barrier from birds to pigs, but was contained on a single farm.⁵²

The H1N1 form of swine flu is one of the descendants of the strain that caused the 1918 flu pandemic.^{53,54} As well as persisting

in pigs, the descendants of the 1918 virus have also circulated in humans through the 20th century, contributing to the normal seasonal epidemics of influenza.⁵⁴ However, direct transmission from pigs to humans is rare, with only 12 cases in the United States since 2005.⁵⁵ Nevertheless, the retention of influenza strains in pigs after these strains have disappeared from the human population might make pigs a reservoir where influenza viruses could persist, later emerging to reinfect humans once human immunity to these strains has waned.⁵⁶

Swine flu has been reported numerous times as a zoonosis in humans, usually with a limited distribution, rarely with a widespread distribution. Outbreaks in swine are common and cause significant economic losses in industry, primarily by causing stunting and extended time to market. For example, this disease costs the British meat industry about £65 million every year.⁵⁷

Annual influenza epidemics are estimated to affect 5–15% of the global population, resulting in severe illness in 3–5 million patients and causing 250,000–500,000 deaths worldwide. In industrialized countries, severe illness and deaths occur mainly in the high-risk populations of infants, the elderly and chronically ill patients.⁵⁸

In addition to these annual epidemics, the influenza A virus caused three major global pandemics during the 20th century: the Spanish flu in 1918, Asian flu in 1957, and Hong Kong flu in 1968–69. These pandemics were caused by influenza A virus that had undergone major genetic changes and for which the population did not possess significant immunity.^{58,59} The overall effects of these pandemics are summarized in Table 1.

The influenza virus has also caused several pandemic threats over the past century, including the pseudo-pandemic of 1947, the 1976 swine flu outbreak, and the 1977 Russian flu, all caused by the H1N1 subtype.⁵⁹ The world has been at an increased level of alert since the SARS epidemic in Southeast Asia (caused by the SARS corona virus).⁶⁰ The level of preparedness was further increased and sustained with the advent of the H5N1 bird flu outbreaks because of H5N1's high fatality rate, although the strains currently prevalent have limited human-to-human transmission (anthroponotic) capability, or epidemicity.^{61,62}

People who contracted flu prior to 1957 may have some immunity. A May 20, 2009, *New York Times* article stated: "Tests on blood serum from older people showed that they had antibodies that attacked the new virus, Dr. Daniel Jernigan, chief flu epidemiologist at the Centers for Disease Control and Prevention, said in a telephone news conference. That does not mean that everyone over 52 is immune, since some Americans and Mexicans older than that have died of the new flu."⁶³

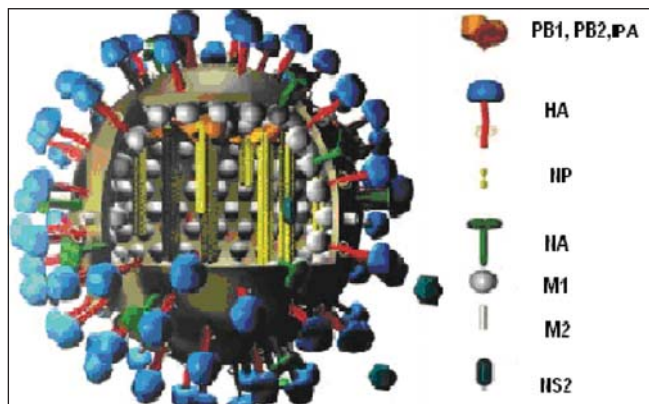


Figure 3: Structure of the influenza viron. (H1N1 Influenza virus)³⁵

1918 pandemic in humans

The 1918 flu pandemic in humans was associated with H1N1 and influenza appearing in pigs;⁵⁴ this may reflect a zoonosis either

Table 1: Flu pandemics over last 100 years^{61,64,65}

Pandemic	Year	Influenza A virus subtype	People infected (approx)	Deaths (est.)	Case fatality rate %
Spanish flu	1918–19	H1N1	1 billion	50 million	>2.5
Asian flu	1957	H2N2	---	2 million	<0.1
Hong Kong flu	1968–69	H3N2	---	1 million	<0.1

from swine to humans or from humans to swine. Although it is not certain in which direction the virus was transferred, some evidence suggests that, in this case, pigs caught the disease from humans. For instance, swine influenza was only noted as a new disease of pigs in 1918, after the first large outbreaks of influenza among people.^[51] Although a recent phylogenetic analysis of more recent strains of influenza in humans, birds, and swine suggests that the 1918 outbreak in humans followed a reassortment event within a mammal,^[66] the exact origin of the 1918 strain remains elusive.^[67]

1976 US outbreak

On February 5, 1976, in the United States an army recruit at Fort Dix said he felt tired and weak. He died the next day and four of his fellow soldiers were later hospitalized. Two weeks after his death, health officials announced that the cause of death was a new strain of swine flu. The strain, a variant of H1N1, is known as A/New Jersey/1976 (H1N1). It was detected only from January 19 to February 9 and did not spread beyond Fort Dix.^[68] This new strain appeared to be closely related to the strain involved in the 1918 flu pandemic. Moreover, the ensuing increased surveillance uncovered another strain in circulation in the United States: A/Victoria/75 (H3N2) spread simultaneously, also caused illness, and persisted until March.^[68] Alarmed public health officials decided action must be taken to head off another major pandemic, and urged President Gerald Ford that every person in the United States be vaccinated for the disease.^[69]

The vaccination program was plagued by delays and public relations problems.^[70] On October 1, 1976, the immunization program began and by October 11, approximately 40 million people, or about 24% of the population, had received swine flu immunizations. That same day, three senior citizens died soon after receiving their swine flu shots and there was a media outcry linking the deaths to the immunizations, despite the lack of positive proof. According to science writer Patrick Di Justo, however, by the time the truth was known—that the deaths were not proven to be related to the vaccine—it was too late. “The government had long feared mass panic about swine flu—now they feared mass panic about the swine flu vaccinations.” This became a strong setback to the program.^[71] There were reports of the Guillain-Barré (GBS) syndrome, a paralyzing neuromuscular disorder, affecting some people who had received swine flu immunizations. This syndrome is a rare side effect of modern influenza vaccines, with an incidence of about one case per million vaccinations.^[72] As a result, Di Justo writes that “the public refused to trust a government-operated health program that killed old people and crippled young people.” In total, less than 33% of the population had been immunized by the end of 1976. The National Influenza Immunization Program was effectively halted on December 16. Overall, there were about 500 cases of the GBS, resulting in death from severe pulmonary complications for 25 people, which, according to Dr. P. Haber, were probably caused by an immunopathological reaction to the 1976 vaccine. Other influenza vaccines have not been linked to GBS, though caution is advised for certain individuals, particularly those with a history of GBS.^[73,74] Still, as observed by a participant in the immunization program, the vaccine killed more Americans than the disease did.^[75]

1988 Zoonosis

In September 1988, a swine flu virus killed one woman and

infected others. —Thirty-two-year-old Barbara Ann Wieners was 8-month pregnant when she and her husband, Ed, became ill after visiting the hog barn at a county fair in Walworth County, Wisconsin. Barbara died 8 days later, after developing pneumonia.^[76] The only pathogen identified was an H1N1 strain of swine influenza virus.^[77] Doctors were able to induce labor and deliver a healthy daughter before she died. Her husband recovered from his symptoms. Influenza like illness (ILI) was reportedly widespread among the pigs exhibited at the fair. A total of 76% of 25 swine exhibitors aged 9–19 tested positive for antibodies to SIV, but no serious illnesses were detected among this group. Additional studies suggested between one and three health care personnel who had contact with the patient developed mild influenza-like illnesses with antibody evidence of swine flu infection. However, there was no community outbreak.^[78,79]

1998 US outbreak in swine

In 1998, swine flu was found in pigs in four US states. Within a year, it had spread through pig populations across the United States. Scientists found that this virus had originated in pigs as a recombinant form of flu strains from birds and humans. This outbreak confirmed that pigs can serve as a crucible where novel influenza viruses emerge as a result of the reassortment of genes from different strains.^[80-82]

2007 Philippine outbreak in swine

On August 20, 2007, Department of Agriculture officers investigated the outbreak (epizootic) of swine flu in Nueva Ecija and Central Luzon, Philippines. The mortality rate is less than 10% for swine flu, unless there are complications like hog cholera. On July 27, 2007, the Philippine National Meat Inspection Service (NMIS) raised a hog cholera “red alert” warning Metro Manila and five regions of Luzon after the disease spread to backyard pig farms in Bulacan and Pampanga, even if these tested negative for the swine flu virus.^[83,84]

2009 Outbreak in humans

The 2009 flu outbreak is due to a new strain of subtype H1N1 not previously reported in pigs.^[85] In late April, Margaret Chan, WHO’s director-general, declared a “public health emergency of international concern” under the rules of WHO’s new International Health Regulations when the first cases of the H1N1 virus were reported in the United States.^[86,87] Following the outbreak, on May 2, 2009, it was reported in pigs at a farm in Alberta, Canada, with a link to the outbreak in Mexico. The pigs were suspected to have caught this new strain of virus from a farm worker who had recently returned from Mexico, and then showed symptoms of an influenza-like illness.^[88] These are probable cases, pending confirmation by laboratory testing. The new strain was initially described as an apparent reassortment of at least four strains of influenza A virus subtype H1N1, including one strain endemic in humans, one endemic in birds, and two endemic in swine.^[8] Subsequent analysis suggested that it was a reassortment of just two strains, both found in swine.^[7] Although initial reports identified the new strain as swine influenza (i.e., a zoonosis originating in swine), its origin is unknown. Several countries took precautionary measures to reduce the chances for a global pandemic of the disease [Table 2].^[89]

Table 2: Detected human cases by country^[90-95]

Country	Cases		Deaths
	Laboratory confirmed [#]	Probable (Suspected) [*]	Confirmed (Suspected) [*]
Mexico	12,954	N/A	92
United States	13,791 [€]	N/A [§]	102 (~100)
Canada	4,806	N/A [§]	85 (~100)
Costa Rica	6,764 [€]	N/A	14
Japan	921	N/A [§]	2
United Kingdom	33	128 (120)	1
Spain	361	N/A	0
Chile	184	N/A (113)	0
Panama	136	0 (57)	0
Australia	119	0	0
South Korea	76	0	0
Ecuador	66	1 (132)	0
Peru	29	0 (24)	0
Argentina	28	0 (1)	0
France	27	0 (0)	0
Italy	19	0 (22)	0
Kuwait	19	0 (19)	0
Germany	19	N/A	0
Colombia	18	N/A	0
Mainland China	17	N/A	0
Hong Kong	16	1 (164)	0
Brazil	13	N/A	0
New Zealand	10	0 (57)	0
Taiwan	9	17	0
Taiwan	9	10 (18)	0
Israel	9	1 (5)	0
Belgium	9	N/A	0
El Salvador	7	N/A	0
Other	6	0 (60)	0

Number of countries with confirmed cases: 55, Number of countries with confirmed or suspected cases: 60, [#]Some authorities have stopped testing all but seriously ill patients,^[91] so many cases will not be confirmed. On May 15, 2009, the CDC's Jan Jernigan estimated that there were "probably upwards of maybe 100,000" cases in the United States.^[92] [§]The governments of Mexico^[93] and Canada^[94] have stopped reporting suspected cases, ^{*}Suspected and probable cases have not been confirmed as being due to this strain of influenza by laboratory tests, although some other strains may have been ruled out, [€]The "confirmed cases" figure for the United States includes probable cases, (y) Virus is known to have been transmitted in country, but no specific numbers available.

Transmission

Transmission between pigs

Influenza is quite common in pigs, with about half of breeding pigs having been exposed to the virus in the United States. Antibodies to the virus are also common in pigs in other countries.^[96] The main route of transmission is through direct contact between infected and uninfected animals.^[47] These close contacts are particularly common during animal transport. Intensive farming may also increase the risk of transmission, as the pigs are raised in very close proximity to each other.^[97,98] The direct transfer of the virus probably occurs either by pigs touching noses, or through dried mucus. Airborne transmission through the aerosols produced by pigs coughing or sneezing is also an important means of infection.^[47] The virus usually spreads quickly through a herd, infecting all the pigs within just a few days.^[5] Transmission may also occur through wild animals, such as wild boar, which can spread the disease between farms.^[99]

Transmission to humans

People who work with poultry and swine, especially people with intense exposures, are at an increased risk of zoonotic infection with influenza virus endemic in these animals, and constitute a population of human hosts in which zoonosis and reassortment can cooccur.^[100] Vaccination of these workers against influenza and surveillance for new influenza strains among this population may therefore be an important public health measure.^[101] The transmission of influenza from swine to humans who work with swine was documented in a small surveillance study performed in 2004 at the University of Iowa.^[102] This study among others forms the basis of a recommendation that people whose jobs involve handling poultry and swine be the focus of increased public health surveillance.^[100] Other professions at particular risk of infection are veterinarians and meat processing workers, although the risk of infection for both of these groups is lower than that of farm workers.^[103]

Interaction with avian H5N1 in pigs

Pigs are unusual as they can be infected with influenza strains that usually infect three different species: pigs, birds, and humans. This makes pigs a host where influenza viruses might exchange genes, producing new and dangerous strains.^[104] Avian influenza virus H3N2 is endemic in pigs in China and has been detected in pigs in Vietnam, increasing fears of the emergence of new variant strains.^[105] H3N2 evolved from H2N2 by an antigenic shift.^[106] In August 2004, researchers in China found H5N1 in pigs.^[107]

These H5N1 infections may be quite common in a survey of 10 apparently healthy pigs housed near poultry farms in West Java, where avian flu had broken out, and 5 of the pig samples contained the H5N1 virus. The Indonesian government has since then found similar results in the same region. Additional tests of 150 pigs outside the area were negative.^[108,109]

Factors of transmitting swine flu

Sneezing and coughing

There are little data available on the risk of airborne transmission of this particular virus. Mexican authorities have distributed surgical masks to the general public. The UK Health Protection Agency considers facial masks unnecessary for the general public.^[110] Many authorities recommend the use of respirators by health care workers in the vicinity of pandemic flu patients, particularly during aerosol generating procedures (e.g., intubations, chest physiotherapy, bronchoscopy).

Touching

Infection can be caused by touching something with flu viruses on it and then touching your mouth or nose. The virus can have a lifetime of up to 2 h outside the body, and thus can be transmitted by handling door knobs, glasses, kitchen utensils, or touching the skin of an infected person and then touching your own mouth or eyes.

Pork consumption

The leading international health agencies have stressed that the "influenza viruses are not known to be transmissible to people through eating processed pork or other food products derived from pigs."^[111]

Signs and symptoms

The signs of infection with swine flu are similar to influenza, and include a fever, coughing, headaches, pain in the muscles or joints, sore throat, chills, fatigue, and runny nose. Diarrhea and vomiting have also been reported in some cases.^[112,113] People at a higher risk of serious complications include people age 65 years and older, children younger than 5 years of age, pregnant women, people of any age with chronic medical conditions (such as asthma, diabetes, or heart disease), and people who are immunosuppressed (e.g., taking immunosuppressive medications or infected with HIV). In children, certain symptoms may require emergency medical attention, including blue lips and skin, dehydration, rapid breathing, excessive sleeping, and significant irritability that includes a lack of desire to be held. In adults, shortness of breath, pain in the chest or abdomen, sudden dizziness or confusion may indicate the need for emergency care. In both children and adults, persistent vomiting or the return of flu-like symptoms that include a fever and cough may require medical attention.^[112]

There is mounting evidence that the symptoms are so far milder than health officials feared. As of May 21, 2009, for instance, despite 201 confirmed cases in New York City, most have been mild and there has been only one confirmed death from the virus.^[114] Similarly, Japan has reported 279, mostly mild flu cases, and no deaths,^[115] with their government now reopening schools, stating that the “virus should be considered more like a seasonal flu.”^[116] In Mexico, where the outbreak began last month, Mexico City officials have lowered their swine flu alert level as no new cases have been reported for a week.^[117]

In swine

In pigs, influenza infection produces fever, lethargy, sneezing, coughing, difficulty in breathing, and decreased appetite. In some cases, the infection can cause abortion. Although mortality is usually low (around 1–4%),^[5] the virus can produce weight loss and poor growth, causing economic loss to farmers. Infected pigs can lose up to 12 pounds of body weight over a 3- to 4-week period [Figure 4].^[47]

In humans

Direct transmission of a swine flu virus from pigs to humans is occasionally possible (called zoonotic swine flu). In all, 50 cases are known to have occurred since the first report in the medical literature in 1958, which have resulted in a total of 6 deaths. Of

these six people, one was pregnant, one had leukemia, one had Hodgkin's disease and two were known to be previously healthy. Despite these apparently low numbers of infections, the true rate of infection may be higher, since most cases only cause a very mild disease, and will probably never be reported or diagnosed.^[119]

According to CDC, in humans the symptoms of the 2009 “swine flu” H1N1 virus are similar to those of influenza and of influenza-like illness in general. Symptoms include fever, cough, sore throat, body aches, headache, chills, and fatigue. The 2009 outbreak has shown an increased percentage of patients reporting diarrhea and vomiting. The 2009 H1N1 virus is not zoonotic swine flu, as it is not transmitted from pigs to humans, but from person to person.^[120]

Because these symptoms are not specific to swine flu, a differential diagnosis of probable swine flu requires not only symptoms but also a high likelihood of swine flu due to the person's recent history. For example, during the 2009 swine flu outbreak in the United States, CDC advised physicians to “consider swine influenza infection in the differential diagnosis of patients with acute febrile respiratory illness who have either been in contact with persons with confirmed swine flu, or who were in one of the five US states that have reported swine flu cases or in Mexico during the 7 days preceding their illness onset.” A diagnosis of confirmed swine flu requires laboratory testing of a respiratory sample (a simple nose and throat swab) [Figure 5].^[121]

Mutation potential

On May 22, 2009, WHO chief Dr. Margaret Chan said that the virus must be closely monitored in the southern hemisphere, as it could mix with ordinary seasonal influenza and change in unpredictable ways. “In cases where the H1N1 virus is widespread and circulating within the general community, countries must expect to see more cases of severe and fatal infections,” she said. “This is a subtle, sneaky virus.”

An international team of researchers who analyzed all eight genes of the new virus confirmed its sneakiness, saying it “was so different from its ancestral strains that it must have been circulating undetected for years.” They confirmed that it is a hybrid of two other mixtures—one a so-called triple reassortant of pig, bird, and human viruses, and another group of swine viruses from Europe and Asia.^[122]

This has led other experts to become concerned that the new virus strain could mutate over the coming months. Guan Yi, a

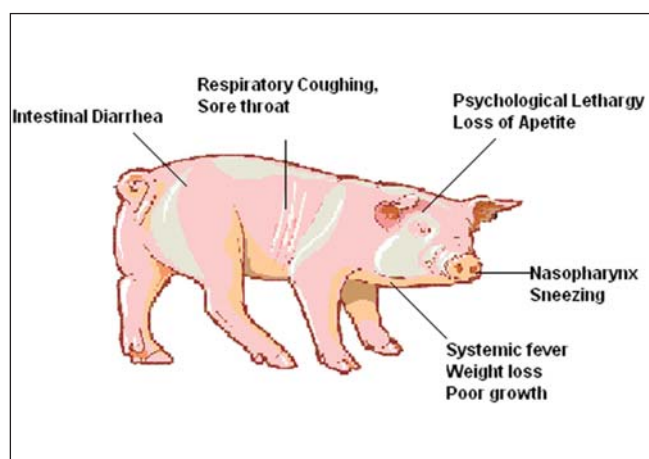


Figure 4: Main symptoms of Swine flu in Pigs^[5]

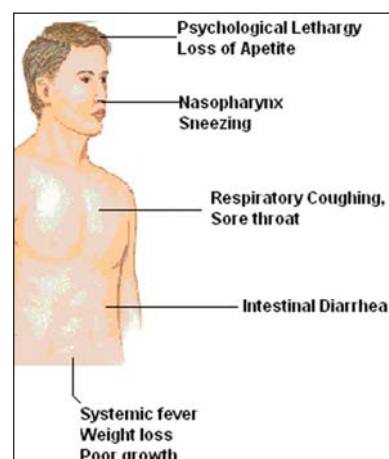


Figure 5: Main symptoms of swine flu in humans^[118]

leading virologist from the University of Hong Kong, for instance, has described the new H1N1 influenza virus as “very unstable,” meaning it could mix and swap genetic material when exposed to other viruses. During an interview, he said “Both H1N1 and H5N1 are unstable so the chances of them exchanging genetic material are higher, whereas a stable (seasonal flu) virus is less likely to take on genetic material.” The H5N1 virus is mostly limited to birds, but in rare cases when it infects humans it has a mortality rate of 60–70%. Experts therefore worry about the emergence of a hybrid of the more dangerous H5N1 with the more transmissible H1N1, especially since H5N1 is now believed to be endemic in countries like China, Indonesia, Vietnam, and Egypt.^[123] The virulence of avian flu is in part due to a nonstructural protein, NS1, which is distinct from its surface antigens and so could potentially be introduced into other flu virus subtypes (subtypes are defined according to their surface antigens—the H and N numbers).^[124]

Pandemic potential

The WHO and CDC officials remain concerned that this outbreak may yet become a pandemic. WHO declared a pandemic alert level of 5, out of a maximum 6, which describes the degree to which the virus has been able to spread among humans, and uses a pandemic severity index, which predicts the number of fatalities if 30% of the human population were infected. By the end of April, however, some scientists believed that this strain was unlikely to cause as many fatalities as earlier pandemics, and may not even be as damaging as a typical flu season.^[126] WHO Director General Margaret Chan, on May 22, continued to stop short of declaring the outbreak a “pandemic,” by moving to alert level 6, because of recent doubts fostered by its mild symptoms to date^[58] along with fear that a pandemic “declaration would trigger mass panic” and be economically and politically damaging to many countries.^[127]

According to some experts, however, the current outbreak is already a pandemic. Michael Osterholm, director of the Center for Infectious Disease Research and Policy of the University of Minneapolis, feels that WHO’s criteria for a pandemic have been met. While Britain’s Health Secretary Alan Johnson has requested that the disease’s severity and other determinants, besides its geographic spread, need to be considered before the pandemic alert is raised to the highest of WHO’s 6-level scale, since a move to phase 6 means that “emergency plans are instantly triggered around the globe.” In addition, at phase 6, many pharmaceutical companies would switch from making seasonal flu shots to pandemic-specific vaccine, “potentially creating shortages of an immunization to counter the

normal winter flu season.” Keiji Fukuda, WHO’s assistant director general of Health Security and Environment, states that a move to phase 6 would “signify a really substantial increase in risk of harm to people.”

Osterholm feels that the primary concern should be “scientific integrity,” stating, “If they want to change the definition, then go ahead. But don’t say that we are not in phase 6 right now because we don’t want to go there.” Rather than redefining what constitutes a pandemic, he suggests that health officials should help people understand that the current threat may resemble the 1957 or 1968 pandemics, in which fewer than 4 million people died, rather than the 1918 Spanish flu, blamed for killing about 50 million [Table 3].^[128]

Prevention

Prevention of swine influenza has three components: prevention in swine, prevention of transmission to humans and prevention of its spread among humans.

Prevention in swine

Methods of preventing the spread of influenza among swine include facility management, herd management, and vaccination. Because much of the illness and death associated with swine flu involves secondary infection by other pathogens, control strategies that rely on vaccination may be insufficient.

Control of swine influenza by vaccination has become more difficult in recent decades, as the evolution of the virus has resulted in inconsistent responses to traditional vaccines. Standard commercial swine flu vaccines are effective in controlling the infection when the virus strains match enough to have significant cross-protection, and custom (autogenous) vaccines made from the specific viruses isolated are created and used in the more difficult cases.^[129,130] Present vaccination strategies for SIV control and prevention in swine farms typically include the use of one of several bivalent SIV vaccines commercially available in the United States. Of the 97 recent H3N2 isolates examined, only 41 isolates had strong serologic cross-reactions with antiserum to three commercial SIV vaccines. Since the protective ability of influenza vaccines depends primarily on the closeness of the match between the vaccine virus and the epidemic virus, the presence of nonreactive H3N2 SIV variants suggests that current commercial vaccines might not effectively protect pigs from infection with a majority of H3N2 viruses.^[131,132] The United States Department of Agriculture

Table 3: WHO pandemic influenza phases (2009)^[125]

Phase	Description
Phase 1	No animal influenza virus circulating among animals have been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Phase 4	Human to human transmission of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Phase 5	The same identified virus has caused sustained community level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community level outbreaks in at least one other country in another WHO region.
Post peak period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Post pandemic period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.

researchers say that while pig vaccination keeps pigs from getting sick, it does not block infection or shedding of the virus.^[133]

Facility management includes using disinfectants and ambient temperature to control virus in the environment. The virus is unlikely to survive outside living cells for more than 2 weeks, except under cold (but above freezing) conditions and it is readily inactivated by disinfectants.^[5] Herd management includes not adding pigs carrying influenza to herds that have not been exposed to the virus. The virus survives in healthy carrier pigs for up to 3 months and can be recovered from them between outbreaks. Carrier pigs are usually responsible for the introduction of SIV into previously uninfected herds and countries, so new animals should be quarantined.^[96] After an outbreak, as immunity in exposed pigs wanes, new outbreaks of the same strain can occur.^[5]

Prevention in humans

Swine can be infected by both avian and human influenza strains of influenza, and therefore are hosts where the antigenic shifts can occur that create new influenza strains.

The transmission from swine to humans is believed to occur mainly in swine farms where farmers are in close contact with live pigs. Although strains of swine influenza are usually not able to infect humans, this may occasionally happen, so farmers and veterinarians are encouraged to use a face mask when dealing with infected animals. The use of vaccines on swine to prevent their infection is a major method of limiting swine-to-human transmission. Risk factors that may contribute to swine-to-human transmission include smoking and not wearing gloves when working with sick animals.^[134]

Prevention of human-to-human transmission

Influenza spreads between humans through coughing or sneezing and people touching something with the virus on it and then touching their own nose or mouth.^[135] Swine flu cannot be spread by pork products, since the virus is not transmitted through food.^[73] The swine flu in humans is most contagious during the first 5 days of the illness although some people, most commonly children, can remain contagious for up to 10 days. Diagnosis can be made by sending a specimen, collected during the first 5 days for analysis.^[136]

Recommendations to prevent spread of the virus among humans include using standard infection control against influenza. This includes frequent washing of hands with soap and water or with alcohol-based hand sanitizers, especially after being out in public.^[137] Chances of transmission are also reduced by disinfecting household surfaces, which can be done effectively with a diluted chlorine bleach solution.^[138] Although the current trivalent influenza vaccine is unlikely to provide protection against the new 2009 H1N1 strain,^[139] vaccines against the new strain are being developed and could be ready as early as June 2009.^[140]

Experts agree that hand-washing can help prevent viral infections, including ordinary influenza and the swine flu virus. Influenza can spread in coughs or sneezes, but an increasing body of evidence shows that small droplets containing the virus can linger on tabletops, telephones, and other surfaces and be transferred via the fingers to the mouth, nose, or eyes. Alcohol-based gel or foam hand sanitizers work well to destroy viruses and bacteria. Anyone with flu-like symptoms such as a sudden fever, cough, or muscle aches should stay away from work or public transportation and should contact a doctor to be tested. Social distancing is another tactic. It

means staying away from other people who might be infected and can include avoiding large gatherings, spreading out a little at work, or perhaps staying home and lying low if an infection is spreading in a community. Public health and other responsible authorities have action plans which may request or require social distancing actions depending on the severity of the outbreak.

Treatment

Treatments for influenza include a range of medications and therapies that are used in response to influenza. Treatments may either directly target the influenza virus itself, or instead they may just offer relief to symptoms of the disease, while the body's own immune system works to recover from infection. The two main classes of antiviral drugs used against influenza are neuraminidase inhibitors, such as zanamivir and oseltamivir, or inhibitors of the viral M2 protein, such as amantadine and rimantadine. These drugs can reduce the severity of symptoms if taken soon after infection and can also be taken to decrease the risk of infection. However, viral strains have emerged that show drug resistance to both classes of drug.

In swine

As swine influenza is rarely fatal to pigs, little treatment beyond rest and supportive care is required.^[96] Instead veterinary efforts are focused on preventing the spread of the virus throughout the farm, or to other farms.^[47] Vaccination and animal management techniques are most important in these efforts. Antibiotics are also used to treat this disease, which although have no effect against the influenza virus, do help prevent bacterial pneumonia and other secondary infections in influenza-weakened herds.^[96]

In humans

If a person becomes sick with swine flu, antiviral drugs can make the illness milder and make the patient feel better faster. They may also prevent serious flu complications. For treatment, antiviral drugs work best if started soon after getting sick (within 2 days of symptoms). Besides antivirals, palliative care, at home or in hospital, focuses on controlling fevers and maintaining fluid balance. The US Centers for Disease Control and Prevention recommends the use of Tamiflu (oseltamivir) or Relenza (zanamivir) for the treatment and/or prevention of infection with swine influenza viruses; however, the majority of people infected with the virus make a full recovery without requiring medical attention or antiviral drugs.^[141] The virus isolates in the 2009 outbreak have been found resistant to amantadine and rimantadine.^[142]

In the United States, on April 27, 2009, the FDA issued Emergency Use Authorizations (EUAs) to make available Relenza and Tamiflu antiviral drugs to treat the swine influenza virus in cases for which they are currently unapproved. The agency issued these EUAs to allow treatment of patients younger than the current approval allows and to allow the widespread distribution of the drugs, including distribution by nonlicensed volunteers.^[143]

Personal hygiene

Recommendations to prevent infection by the virus consist of the standard personal precautions against influenza. This includes

frequent washing of hands with soap and water or with alcohol-based hand sanitizers, especially after being out in public. The CDC advises not touching the mouth, nose, or eyes, as these are primary modes of transmission. When coughing, they recommend coughing into a tissue and disposing of the tissue, then immediately washing the hands.^[144] Chances of transmission are also reduced by disinfecting household surfaces, which can be done effectively with a diluted chlorine bleach solution.^[145]

Symptomatic treatment

The US authority on disease prevention, the Centers for Disease Control and Prevention, recommends that persons suffering from influenza infections

- Stay at home
- Get plenty of rest
- Drink a lot of liquids
- Do not smoke or drink alcohol
- Consider over-the-counter medications to relieve flu symptoms
- Consult a doctor early on for best possible treatment
- Remain alert for emergency warning signs.

Warning signs are symptoms that indicate that the disease is becoming serious and needs immediate medical attention. These include

- Difficulty in breathing or shortness of breath
- Pain or pressure in the chest or abdomen
- Dizziness
- Confusion
- Severe or persistent vomiting.

In children, other warning signs include irritability, failing to wake up and interact, rapid breathing, and a bluish skin color. Another warning sign in children is the flu symptoms appear to resolve, but then reappear with fever and a bad cough.^[159,160]

Antiviral drugs

According to the CDC, antiviral drugs can be given to treat those who become severely ill; however, these antiviral drugs are prescription medicines (pills, liquid, or an inhaler) and act against influenza viruses, including the H1N1 flu virus. There are two influenza antiviral medications that are recommended for use against the H1N1 flu. The drugs that are used for treating the H1N1 flu are called “oseltamivir” (Tamiflu) and “zanamivir” (Relenza). The CDC notes that as the H1N1 flu spreads, these antiviral drugs may become short in supply. Therefore, the drugs will be given first to those people who have been hospitalized or are at a high risk of complications. The drugs work best if given within 2 days of becoming ill, but may be given later if illness is severe or used for

those at a high risk for complications.

When buying these medications, some agencies such as the “MHRA” in the UK have recommended not using online sources, as the WHO estimates that half the drugs sold by online pharmacies without a physical address are counterfeit.^[146] Medical experts are also concerned that people “racing to grab up antiviral drugs just to feel safe” may eventually lead to the virus developing drug resistance. Partly as a result, experts suggest the medications should be reserved for only the very ill or people with severe immune deficiencies.^[147]

In H3N2 strains, Tamiflu treatment leads to resistance in 0.4% of adult cases and 5.5% of children. Resistant strains are usually less transmissible; nonetheless, resistant human H1N1 viruses became widely established in previous flu seasons. Marie-Paule Kiely, WHO vaccine research director, has said that it is “almost a given” that the new strain would undergo reassortment with resistant seasonal flu viruses and acquire resistance, but it is not yet known at what level resistance will appear.^[148] Simulations suggest that if physicians choose a second effective antiviral such as zanamivir (Relenza) as first-line treatment in even a few percent of cases, this can greatly delay the spread of resistant strains. Even a drug such as amantadine (Symmetrel) for which resistance frequently emerges may be useful in combination therapy.^[149,150]

Antiviral treatment for novel (H1N1) influenza^[151]

For antiviral treatment of novel influenza (H1N1) virus infection, either oseltamivir or zanamivir is recommended [Table 4]. Recommendations for the use of antivirals may change as data on antiviral effectiveness, clinical spectrum of illness, adverse events from antiviral use, and antiviral susceptibility become available.

Clinical judgment is an important factor in treatment decisions. Persons with suspected novel H1N1 influenza who present with an uncomplicated febrile illness typically do not require treatment unless they are at a higher risk for influenza complications, and in areas with limited antiviral medication availability, local public health authorities might provide additional guidance about prioritizing treatment within groups at a higher risk for infection.

Treatment is recommended for:

1. All hospitalized patients with confirmed, probable, or suspected novel influenza (H1N1).
2. Patients who are at a higher risk for seasonal influenza complications.

If a patient is not in a high-risk group or is not hospitalized, health care providers should use clinical judgment to guide treatment

Table 4: Antiviral medication dosing recommendations for treatment or chemoprophylaxis of novel influenza A (H1N1) infection.^[158]

Agent, group	Treatment	Chemoprophylaxis
	Oseltamivir	
Adults	75-mg capsule twice per day for 5 days	75-mg capsule once per day
Children ≥ 12 months	15 kg or less	30 mg once per day
	15-23 kg	45 mg once per day
	24-40 kg	60 mg once per day
	>40 kg	75 mg once per day
	Zanamivir	
Adults	Two 5-mg inhalations (10 mg total) twice per day	Two 5-mg inhalations (10 mg total) once per day
Children 8	Two 5-mg inhalations (10 mg total) twice per day (age, 7 years or older)	Two 5-mg inhalations (10 mg total) once per day (age, 5 years or older)

decisions, and when evaluating children should be aware that the risk for severe complications from seasonal influenza among children younger than 5 years of age is highest among children younger than 2 years of age. Many patients who have had novel influenza (H1N1) virus infection, but who are not in a high-risk group have had a self-limited respiratory illness similar to typical seasonal influenza. For most of these patients, the benefits of using antivirals may be modest. Therefore, testing, treatment, and chemoprophylaxis efforts should be directed primarily at persons who are hospitalized or at a higher risk for influenza complications.

Once the decision to administer antiviral treatment is made, treatment with zanamivir or oseltamivir should be initiated as soon as possible after the onset of symptoms. Evidence for benefits from antiviral treatment in studies of seasonal influenza is strongest when treatment is started within 48 h of illness onset. However, some studies of oseltamivir treatment of hospitalized patients with seasonal influenza have indicated benefit, including reductions in mortality or duration of hospitalization even for patients whose treatment was started more than 48 h after the illness onset. Recommended duration of treatment is 5 days. Antiviral doses recommended for the treatment of novel H1N1 influenza virus infection in adults or children 1 year of age or older are the same as those recommended for seasonal influenza [Table 5]. Oseltamivir use for children younger than 1 year of age was recently approved by the US Food and Drug Administration (FDA) under an EUA, and dosing for these children is age based [Table 6].

Antiviral chemoprophylaxis for novel (H1N1) influenza^[152]

For antiviral chemoprophylaxis of novel (H1N1) influenza virus infection, either oseltamivir or zanamivir is recommended [Table 5]. The duration of antiviral chemoprophylaxis *postexposure* is 10 days after the last known exposure to novel (H1N1) influenza. The indication for postexposure chemoprophylaxis is based upon close contact with a person who is a confirmed, probable, or suspected case of novel influenza A (H1N1) virus infection during the infectious period of the case. The infectious period for persons infected with the novel influenza A (H1N1) virus is assumed to be similar to that observed in studies of seasonal influenza. With seasonal influenza, studies have shown that people may be able to transmit infection beginning 1 day before they develop symptoms to up to

7 days after they get sick. Children, especially younger children, might potentially be infectious for longer periods. However, for this guidance, the *infectious period* is defined as 1 day before until 7 days after the case's onset of illness. If the contact occurred with a case whose illness started more than 7 days before contact with the person under consideration for antivirals, then chemoprophylaxis is not necessary. For *pre-exposure* chemoprophylaxis, antiviral medications should be given during the potential exposure period and continued for 10 days after the last known exposure to a person with novel (H1N1) influenza virus infection during the case's infectious period. Oseltamivir can also be used for chemoprophylaxis under the EUA for children less than 1 year of age.

Postexposure antiviral chemoprophylaxis with either oseltamivir or zanamivir can be considered for the following:

1. Close contacts of cases (confirmed, probable, or suspected) who are at a high risk for complications of influenza.
2. Health care personnel, public health workers, or first responders who have had a recognized, unprotected close contact exposure to a person with novel (H1N1) influenza virus infection (confirmed, probable, or suspected) during that person's infectious period.

Pre-exposure antiviral chemoprophylaxis should only be used in limited circumstances, and in consultation with local medical or public health authorities. Certain persons at an ongoing occupational risk for exposure who are also at a higher risk for complications of influenza (e.g., health care personnel, public health workers, or first responders who are working in communities with influenza A H1N1 outbreaks) should carefully follow guidelines for appropriate personal protective equipment or consider temporary reassignment.

Antiviral use for the control of novel H1N1 influenza outbreaks^[153-155]

The use of antiviral drugs for the treatment and chemoprophylaxis of influenza has been a cornerstone for the control of seasonal influenza outbreaks in nursing homes and other long-term care facilities. At this time, no outbreaks of novel influenza A (H1N1) have been reported in such settings. However, if such outbreaks were to occur, it is recommended that ill patients be treated with oseltamivir or zanamivir and that chemoprophylaxis with either oseltamivir or zanamivir be started as early as possible to reduce the spread of the virus as is recommended for seasonal influenza outbreaks in such settings. Chemoprophylaxis should be administered to all nonill residents and should continue for a minimum of 2 weeks. If surveillance indicates that new cases continue to occur, chemoprophylaxis should be continued until approximately 7 days after the illness onset in the last patient. In addition to antiviral medications, other outbreak-control measures include appropriate infection control, establishing cohorts of patients with confirmed or suspected influenza, restricting staff movement between wards or buildings, and restricting contact between ill staff or visitors and patients, and active surveillance for new cases. Medical directors of long-term care facilities should review their plans for the outbreak control of influenza. In addition to use in nursing homes, antiviral chemoprophylaxis also can be considered for controlling influenza outbreaks in other closed or semiclosed settings (e.g., correctional facilities, or other settings in which persons live in close proximity).

Children under 1 year of age

Children under 1 year of age are at a high risk for complications

Table 5: Dosing recommendations for antiviral treatment of children younger than 1 year using oseltamivir

Age	Recommended treatment dose for 5 days
<3 months	12 mg twice daily
3-5 months	20 mg twice daily
6-11 months	25 mg twice daily

Table 6: Dosing recommendations for antiviral chemoprophylaxis of children younger than 1 year using oseltamivir

Age	Recommended prophylaxis dose for 10 days
<3 months	Not recommended unless situation judged critical due to limited data on use in this age group
3-5 months	20 mg once daily
6-11 months	25 mg once daily

from seasonal human influenza virus infection. The characteristics of human infection novel (H1N1) influenza virus are still being studied, and it is not known whether infants are at a higher risk for complications associated with novel (H1N1) influenza virus infection compared to older children and adults. Oseltamivir is not licensed for use in children less than 1 year of age. However, limited safety data on oseltamivir treatment for seasonal influenza in children less than 1 year of age suggest that severe adverse events are rare [Table 7].^[156]

Vaccines

The purpose of a vaccine is to prime the body's immune system so that it is able to respond rapidly if it is later exposed to that particular disease. The immune system fights viral diseases such as flu by recognizing proteins (antigens) on or in the virus. A flu vaccine contains either a safe version of the virus, or copies of its proteins. It causes the immune cells that recognize these proteins to replicate so that they are primed to respond to a later attack by this virus. The vaccine does not itself cause flu, as it does not contain a virus which could replicate within the body—if a whole virus is used, it is killed before the vaccine is created. Using a whole virus, rather than just isolated proteins, typically leads to a stronger immune response. It can also lead to “cross-protection”—protection against strains of a virus whose proteins differ slightly. This is useful if the virus infecting the population undergoes a mutation, in which its structure changes. For these reasons, vaccines made from isolated proteins may also contain an adjuvant—a chemical designed to enhance the immune system's response to the viral protein, and to maximize cross-protection.^[157]

Development of an H1N1 vaccine

A vaccine against the newly emerging strain of H1N1 could stop or slow its spread, and thus reduce its impact on health services, workplaces, schools, and the economy. Since this virus differs markedly from previous strains of H1N1, existing flu vaccines will not work against it and a new vaccine needs to be developed. Several different companies have the technology necessary to develop such a vaccine. This involves making a preparation of the flu virus that will cause an immune response without leading to symptoms of the disease. This is done either by using killed flu viruses, or by using proteins isolated from the virus. Vaccine development begins with a sample of the virus responsible for the disease outbreak. Samples of the H1N1 virus have been received by the Health Protection Agency's National Institute of Biological Standards and Control (NIBSC), which is developing a strain of the virus suitable for use in vaccine development with the aim of passing it onto vaccine manufacturers.^[157]

Symptom(s)	OTC Medicine
Fever, aches, pains, sinus pressure, sore throat	Analgesics
Nasal congestion, sinus pressure	Decongestants
Sinus pressure, runny nose, watery eyes, cough	Antihistamines
Cough	Cough suppressant
Sore throat	Local anesthetics

Conclusion

A new H1N1 influenza A virus has been identified in Mexico, and has spread rapidly to other regions around the world. The World Health Organization in collaboration with many other national and international agencies is working efficiently to evaluate, diagnose, and implement measures to contain the spread of this virus. Among the many efforts is the timely release of the genomic sequences from different viral isolates. The preliminary analyses show that the closest relatives to this new strain are found in swine, and occasionally in turkeys. Six segments of the virus are related to swine viruses from North America and the other two (NA and M) to swine viruses isolated in Europe/Asia. The closest clusters (for the HA segment) in the NCBI data base are North America swine influenza A (H1N2) and H3N2s. The closest relatives of the neuraminidase (NA) gene of the new virus are influenza A isolates from 1992. As more data become accessible, the evolution of this gene could be clarified. Swine flu is a respiratory disease and has some elements of a virus found in pigs. There is no evidence of this disease circulating in pigs; scientists are investigating its origins. Swine flu has been confirmed in a number of countries and it is spreading from human to human, which could lead to what is referred to as a pandemic flu outbreak. Flu viruses change over time. It is difficult to say if the current outbreak will suddenly stop, or will continue. Health officials continue to monitor the situation. Plans for pandemic and emergency responses are ready for use. Pandemic flu is different from ordinary flu because it's a new flu virus that appears in humans and spreads very quickly from person to person worldwide. WHO is closely monitoring cases of swine flu globally to see whether this virus develops into a pandemic. Because it's a new virus, no one will have immunity to it and everyone could be at risk of catching it. This includes healthy adults as well as older people, young children, and those with existing medical conditions. Flu viruses are made up of tiny particles that can be spread through the droplets that come out of your nose and mouth when you cough or sneeze. When you cough or sneeze without covering your nose and mouth with a tissue, those droplets can spread and others will be at risk of breathing them in. If you cough or sneeze into your hand, those droplets and the germs in them are then easily spread from your hand to any hard surfaces that you touch, and they can live on those surfaces for some time. Everyday items such as door handles, computer keyboards, mobile and ordinary phones, and the TV remote control are all common surfaces where flu viruses can be found. If other people touch these surfaces and then touch their faces, the germs can enter their systems and they can become infected. That's how all cold and flu viruses, including swine flu, are passed on from person to person. The best thing you can do to protect yourself is to follow good hygiene practices. These will help to slow the spread of the virus and will be the single most effective thing you can do to protect yourself and others from infection. According to the Centre for Disease control and Prevention, the fact that the flu's infection activity is now monitored more closely may help explain why more flu cases than normal are being recorded in Mexico, the United States, and other countries. About half of all influenza viruses being detected so far are the new H1N1 virus, which experts acknowledge is no worse than seasonal influenza for now. Human cases of a new form of influenza virus have been identified in the United States, Mexico, Canada, Spain, Israel, UK, and New Zealand. The majority of cases outside Mexico are still being reported as a mild illness only. The pandemic alert level has

been raised by the World Health Organization if you have a flu-like illness (fever and cough and fatigue) and have traveled to Mexico, USA, or Canada in past few days. Current information suggests antiviral drugs (Tamiflu and Relenza) are useful against these swine influenza viruses. These drugs are available through pharmacists and can be prescribed by GPs. Among all countries, Australia has very good communicable disease surveillance and control systems in place to detect and respond to outbreaks of illness. The World Health Organization has declared this to be a public health emergency of international concern.

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