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H1N1/09 Influenza: 20th Century flu pandemics

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ABSTRACT

Swine influenza (also called Pig influenza, swine flu, hog flu and pig flu) is an infection by any one of several types of swine influenza virus. Swine influenza virus (SIV) or S-OIV (swine-origin influenza virus) is any strain of the influenza family of viruses that is endemic in pigs. As of 2009, the known SIV strains include influenza C and the subtypes of influenza A known as H1N1, H1N2, H3N1, H3N2, and H2N3. Swine influenza virus is common throughout pig populations worldwide. Transmission of the virus from pigs to humans is not common and does not always lead to human influenza, often resulting only in the production of antibodies in the blood. If transmission does cause human influenza, it is called zoonotic swine flu. People with regular exposure to pigs are at increased risk of swine flu infection. The meat of infected animal posses no risk of infection when properly cooked.

INTRODUCTION

The 2009 flu pandemic is a global outbreak of a new strain of H1N1 influenza virus, often referred to as "swine flu" in the media. Although the virus, first detected in April 2009, contains a combination of genes from swine, avian (bird), and human influenza viruses, it cannot be spread by eating pork products or being around pigs. The outbreak began in Veracruz, Mexico, with evidence that there had been an ongoing epidemic for months before it was officially recognized as such. The Mexican government closed most of Mexico City's public and private

facilities in an attempt to contain the spread of the virus. However the virus continued to spread globally, clinics were overwhelmed by people infected, and the World Health Organization (WHO) and US Centers for Disease Control (CDC) stopped counting cases and in June declared the outbreak to be a pandemic.

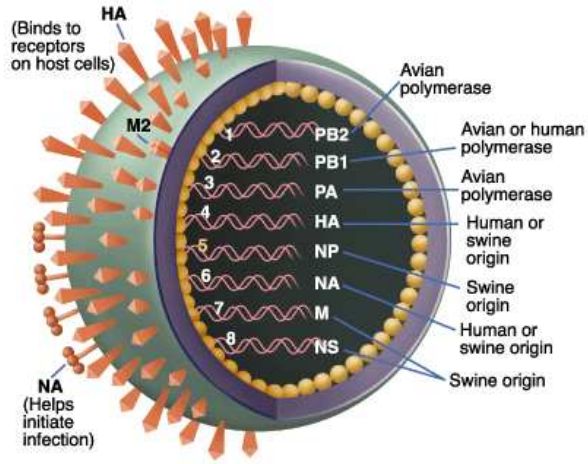

Figure-1

While only mild symptoms are experienced by the majority of people, some have more severe symptoms. Mild symptoms may include fever, sore throat, cough, headache, muscle or joint pains, and nausea, vomiting, or diarrhea. Those at risk of a more severe infection include: asthmatics, diabetics, those with obesity, heart disease, the immunocompromised, children with neurodevelopmental conditions, and pregnant women. In addition, even for persons previously very healthy, a small percentage of patients will develop viral pneumonia. This manifests itself as increased breathing difficulty and typically occurs 3–6 days after initial onset of flu symptoms. Similar to other influenza viruses, pandemic H1N1 is typically contracted by person to person transmission through respiratory droplets. Symptoms usually last 4–6 days. To avoid spreading the infection, it is recommended that those with symptoms stay home, away from school, work and crowded places. Those with more severe symptoms or those in an at risk group may benefit from antivirals (oseltamivir or zanamivir). As of December 4, 2009 (2009 -12-04)[update], there are 9,797 confirmed deaths worldwide. This figure is a sum of confirmed deaths reported by national authorities and the WHO states that total mortality (including deaths unconfirmed or unreported) from the new H1N1 strain is "unquestionably higher" than this [1].

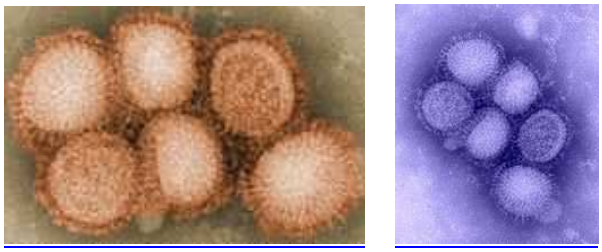

Figure-2: Electron microscope image of the reassorted H1N1 influenza virus
The viruses are ~100 nanometres in diameter

Pandemic H1N1/09 Influenza

During the mid-20th century, identification of influenza subtypes became possible, allowing accurate diagnosis of transmission to humans. Since then, only 50 such transmissions have been confirmed. These strains of swine flu rarely pass from human to human. Symptoms of zoonotic swine flu in humans are similar to those of influenza and of influenza-like illness in general, namely chills, fever, sore throat, muscle pains, severe headache, coughing, weakness and general discomfort.

Classification

Of the three genera of influenza viruses that cause human flu, two also cause influenza in pigs, with influenza A being common in pigs and influenza C being rare. Influenza B has not been reported in pigs. Within influenza A and influenza C, the strains found in pigs and humans are largely distinct, although because of 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. Transmission between pigs and humans has occurred in the past. For example, influenza C caused small outbreaks of a mild form of influenza amongst children in Japan and California. Because of its limited host range and the lack of genetic diversity in influenza C, this form of influenza does not cause pandemics in humans.

Influenza A

Swine influenza is known to be caused by influenza A subtypes H1N1, H1N2, H2N3, H3N1 and H3N2. In pigs, three influenza A virus subtypes (H1N1, H1N2, and H3N2) are the most common strains worldwide. 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.

Surveillance

Although there is no formal national surveillance system in the United States to determine what viruses are circulating in pigs, there is an informal surveillance network in the United States that is part of a world surveillance network. Veterinary medical pathologist, Tracey McNamara, set up a national disease surveillance system in zoos because the zoos do active disease surveillance and many of the exotic animals housed there have broad susceptibilities. Many species fall below the radar of any federal agencies (including dogs, cats, pet prairie dogs, zoo animals, and urban wildlife), even though they may be important in the early detection of human disease outbreaks.

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. The first identification of an influenza virus as a cause of disease in pigs occurred about ten 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 [2].

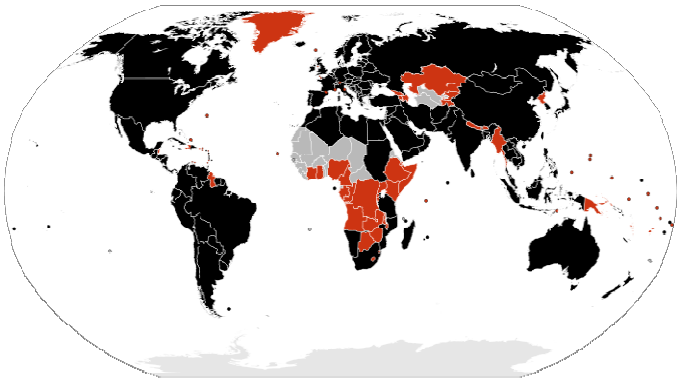

Figure 2: Swine flu pandemics globally

The H1N1 form of swine flu is one of the descendants of the strain that caused the 1918 flu pandemic. 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. However, direct transmission from pigs to humans is rare, with only 12 cases in the U.S. since 2005. 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. Swine flu has been reported numerous times as a zoonosis in humans, usually with 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.

1918 pandemic in humans: The 1918 flu pandemic in humans was associated with H1N1 and influenza appearing in pigs; this may reflect a zoonosis either 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 amongst people. 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, the exact origin of the 1918 strain remains elusive. It is estimated that anywhere from 50 to 100 million people were killed worldwide. 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. 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 U.S.: A/Victoria/75 (H3N2) spread simultaneously,

also caused illness, and persisted until March. There were reports of Guillain-Barré syndrome, a paralyzing neuromuscular disorder, affecting some people who had received swine flu immunizations. Although if a link exists is still not clear, this syndrome may be a rare side-effect of influenza vaccines. 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, 48,161,019 Americans, or just over 22% of the population, had been immunized by the time the National Influenza Immunization Program (NIIP) was effectively halted on December 16, 1976.

Overall, there were 1098 cases of Guillain-Barré Syndrome (GBS) recorded nationwide by CDC surveillance, 532 of which occurred after vaccination and 543 before vaccination. There are about one to two cases of GBS per 100,000 people every year, whether or not people have been vaccinated. The vaccination program seems to have increased this normal risk of developing GBS by about to one extra case per 100,000 vaccinations. The CDC states that most studies on modern influenza vaccines have seen no link with GBS. Although one review gives an incidence of about one case per million vaccinations [3].

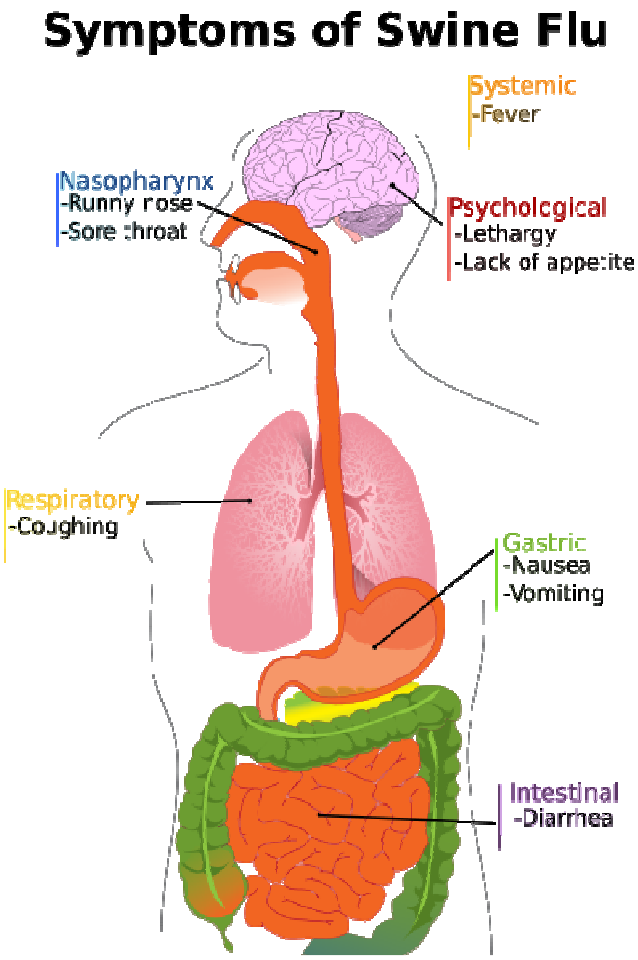

Figure 3: Symptoms and prophylaxis of flu

1988 zoonosis: In September 1988, a swine flu virus killed one woman and infected others. 32-year old Barbara Ann Wieners was eight months pregnant when she and her husband, Ed, became ill after visiting the hog barn at a county fair in Walworth County, Wisconsin. Barbara died eight days later, after developing pneumonia. The only pathogen identified was an H1N1 strain of swine influenza virus. 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. Of the 25 swine exhibitors aged 9 to 19 at the fair, 19 tested positive for antibodies to SIV, but no serious illnesses were seen. The virus was able to spread between people, since 1-3 health care personnel who had cared for the pregnant woman developed mild influenza-like illnesses, and antibody tests suggested that they had been infected with swine flu. However, there was no community outbreak.

1998 US outbreak in swine: In 1998, swine flu was found in pigs in four U.S. 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 [3]. Genetic components of these 1998 triple-hybrid stains would later form six out of the eight viral gene segments in the 2009 flu outbreak.

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 over Metro Manila and 5 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.

2009 flu pandemic data

Area	Confirmed deaths	Increase in last 7 days
Worldwide (total)	9,797	+1,229 (13%)
European Union and EFTA	1,066	+208 (20%)
Other European countries and Central Asia	155	+46 (30%)
Mediterranean and Middle East	775	+129 (17%)
Africa	111	+3 (3%)
North America	2,845	+661 (23%)
Central America and Caribbean	196	+21 (11%)
South America	2,998	+20 (1%)
Northeast Asia and South Asia	1,061	+138 (13%)
Southeast Asia	374	+3 (1%)
Australia and Pacific	216	+0 (0%)

Source: ECDC – December 7, 2009[2]

2009 outbreak in humans: The H1N1 viral strain implicated in the 2009 flu pandemic among humans often is called "swine flu" because initial testing showed many of the genes in the virus

were similar to influenza viruses normally occurring in North American swine. Further research has shown that three-quarters or six out of the eight gene segments of the 2009 virus arose from the 1998 North American swine flu strains which emerged from the first-ever reported triple-hybrid virus of 1998. In late April, Margaret Chan, the World Health Organization's director-general, declared a "public health emergency of international concern" under the rules of the WHO's new International Health Regulations when the first two cases of the H1N1 virus were reported in the United States, followed by hundreds of cases in Mexico. Following the initial cases in the USA and Mexico, 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 are suspected to have caught this new strain of virus from a farm worker who recently returned from Mexico, then showed symptoms of an influenza-like illness. 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. Subsequent analysis suggested it was a reassortment of just two strains, both found in swine. Although initial reports identified the new strain as swine influenza (i.e., a zoonosis originating in swine), its genetic origin was only later revealed to have been mostly a descendant of the triple-reassortment virus which emerged in factory farms in the United States in 1998. Several countries took precautionary measures to reduce the chances for a global pandemic of the disease. The 2009 swine flu has been compared to other similar types of influenza virus in terms of mortality: "in the US it appears that for every 1000 people who get infected, about 40 people need admission to hospital and about one person dies." There are fears that swine flu will become a major global pandemic at the end of the year (coinciding with the Northern Hemisphere winter months), with many countries planning major vaccination campaigns [4].

Transmission

Transmission between pigs: Influenza is quite common in pigs, with about half of breeding pigs having been exposed to the virus in the US. Antibodies to the virus are also common in pigs in other countries. The main route of transmission is through direct contact between infected and uninfected animals. 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. The direct transfer of the virus probably occurs either by pigs touching noses, or through dried mucus. Airborne transmissions through the aerosols produced by pigs coughing or sneezing are also an important means of infection. The virus usually spreads quickly through a herd, infecting all the pigs within just a few days. Transmission may also occur through wild animals, such as wild boar, which can spread the disease between farms.

Transmission to humans: People who work with poultry and swine, especially people with intense exposures, are at 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 co-occur. Vaccination of these workers against influenza and surveillance for new influenza strains among this population may therefore be an important public health measure. 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. 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. 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.

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. 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. H3N2 evolved from H2N2 by antigenic shift. In August 2004, researchers in China found H5N1 in pigs. 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, five of the pig samples contained the H5N1 virus. The Indonesian government has since found similar results in the same region. Additional tests of 150 pigs outside the area were negative [5].

Signs and symptoms

In swine: In pigs influenza infection produces fever, lethargy, sneezing, coughing, difficulty breathing and decreased appetite. In some cases the infection can cause abortion. Although mortality is usually low (around 1–4%), 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.

In humans: The symptoms of swine flu are similar to other influenzas, and may include a fever, cough (typically a "dry cough"), headache, muscle or joint pain, sore throat, chills, fatigue, and runny nose. Diarrhea, vomiting, and neurological problems have also been reported in some cases. People at higher risk of serious complications include those aged over 65, children younger than 5, children with neurodevelopmental conditions, pregnant women (especially during the third trimester), and those of any age with underlying medical conditions, such as asthma, diabetes, obesity, heart disease, or a weakened immune system (e.g., taking immunosuppressive medications or infected with HIV). More than 70% of hospitalizations in the US have been people with such underlying conditions, according to the CDC. A study from Australia and New Zealand estimated that the demand for ICU beds due to viral pneumonia was much higher during the pandemic than in previous influenza seasons. A Canadian study reported that intensive care capacity in Winnipeg, Manitoba was "seriously challenged" at the peak of the outbreak, with full occupancy of all regional ICU beds.

In adults: In adults, shortness of breath, pain in the chest or abdomen, sudden dizziness, or confusion may require 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. If it follows the same pattern as in children, a relapse with high fever may in fact be pneumonia.

In children: As with the seasonal flu, certain symptoms may require emergency medical attention. In children, signs of respiratory distress include blue lips and skin, dehydration, rapid breathing, excessive sleeping, seizures, and significant irritability including a lack of desire to be held [6].

Figure 4: Thermal scanning of passengers arriving at Singapore Changi airport

The CDC recommends real time RT-PCR as the method of choice for diagnosing H1N1. This method allows a specific diagnosis of novel influenza (H1N1) as opposed to seasonal influenza. Near-patient point of care tests are in development.

Prevention

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

Diagnosis

In swine: Methods of preventing the spread of influenza among swine include facility management, herd management, and vaccination (ATCvet code: QI09AA03). 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. 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. The United States Department of Agriculture researchers say that while pig vaccination keeps pigs from getting sick, it does not block infection or shedding of the virus [7].

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 human 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. 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. Swine flu cannot be spread by pork products, since the virus is not transmitted through food. The swine flu in humans is most contagious during the first five days of the illness although some people, most commonly children, can remain contagious for up to ten days. Diagnosis can be made by sending a specimen, collected during the first five days for analysis.

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. Chance of transmission is also reduced by disinfecting household surfaces, which can be done effectively with a diluted chlorine bleach solution. Experts agree that hand-washing can help prevent viral infections, including ordinary influenza and the swine flu virus. Also avoiding touching eyes, nose and mouth with hands prevents flu. Influenza can spread in coughs or sneezes, but an increasing body of evidence shows 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 for advice. 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 [8].

Figure 5: Thermal imaging camera & screen, photographed in an airport terminal in Greece
Thermal imaging can detect elevated body temperature, one of the signs of the virus N1H1 (Swine influenza)

Vaccination

Vaccines are available for different kinds of swine flu. The U.S. Food and Drug Administration (FDA) approved the new swine flu vaccine for use in the United States on September 15, 2009. Studies by the National Institutes of Health (NIH), show that a single dose creates enough antibodies to protect against the virus within about 10 days.

Treatment

In swine: As swine influenza is rarely fatal to pigs, little treatment beyond rest and supportive care is required. Instead veterinary efforts are focused on preventing the spread of the virus throughout the farm, or to other farms. Vaccination and animal management techniques are most

important in these efforts. Antibiotics are also used to treat this disease, which although they have no effect against the influenza virus, do help prevent bacterial pneumonia and other secondary infections in influenza-weakened herds.

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). Beside antivirals, supportive care at home or in hospital, focuses on controlling fevers, relieving pain and maintaining fluid balance, as well as identifying and treating any secondary infections or other medical problems. The U.S. 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. The virus isolates in the 2009 outbreak have been found resistant to amantadine and rimantadine. In the U.S., on April 27, 2009, the FDA issued Emergency Use Authorizations 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 by non-licensed volunteers [9].

Diagnosis

Confirmed diagnosis of pandemic H1N1/09 flu requires testing of a nasopharyngeal, nasal, or oropharyngeal tissue swab from the patient. Real-time RT-PCR is the recommended test as others are unable to differentiate between pandemic H1N1/09 and regular seasonal flu. However, most people with flu symptoms do not need a test for pandemic H1N1/09 flu specifically, because the test results usually do not affect the recommended course of treatment. The CDC recommends testing only for people who are hospitalized with suspected flu, pregnant women, and people with weakened immune systems. For the mere diagnosis of influenza and not pandemic H1N1/09 flu specifically, more widely available tests include rapid influenza diagnostic tests (RIDT), which yield results in about 30 minutes, and direct and indirect immunofluorescence assays (DFA and IFA), which take 2–4 hours; DFA and IFA are more sensitive to pandemic H1N1/09 virus than RIDT. Due to the high rate of RIDT false negatives, the CDC advises that patients with illnesses compatible with novel influenza A (H1N1) virus infection but with negative RIDT results should be treated empirically based on the level of clinical suspicion, underlying medical conditions, severity of illness, and risk for complications, and if a more definitive determination of infection with influenza virus is required, testing with rRT-PCR or virus isolation should be performed [10].

Virus characteristics: Regarding the probable or possible history of novel H1N1, a July 9, 2009, New England Journal of Medicine article states: "H1N2 and other subtypes are descendants of the triple-reassortant swine H3N2 viruses isolated in North America. They have spread in swine hosts around the globe and have been found to infect humans. The segments coding for the neuraminidase and the matrix proteins of the new human H1N1 virus are, however, distantly related to swine viruses isolated in Europe in the early 1990s."

Transmission: Spread of the H1N1 virus is thought to occur in the same way that seasonal flu spreads. Flu viruses are spread mainly from person to person through coughing or sneezing by people with influenza. Sometimes people may become infected by touching something – such as a surface or object – with flu viruses on it and then touching their mouth or nose. The basic reproduction number (the average number of other individuals that each infected individual will infect, in a population that has no immunity to the disease) for the 2009 novel H1N1 is estimated to be 1.75. The H1N1 virus has been transmitted to animals, including swine, turkeys, ferrets, household cats, and a cheetah.

Vaccines: As of November 19, 2009 (2009 -11-19), over 65 million doses of vaccine had been administered in over 16 countries; the vaccine seems safe and effective, producing a strong immune response that should protect against infection. The current trivalent seasonal influenza vaccine neither increases nor decreases the risk of infection with H1N1, since the new pandemic strain is quite different from the strains used in this vaccine. Overall the safety profile of the new H1N1 vaccine is similar to that of the seasonal flu vaccine, and fewer than a dozen cases of Guillain-Barre syndrome have been reported post-vaccination. Only a few of these are suspected to be actually related to the H1N1 vaccination, and only temporary illness has been observed. This is in strong contrast to the 1976 swine flu outbreak, where mass vaccinations in the United States caused over 500 cases of Guillain-Barre syndrome and led to 25 deaths.

There are safety concerns for people who are allergic to eggs because the viruses for the vaccine are grown in chicken-egg-based cultures. People with egg allergies may be able to receive the vaccine, after consultation with their physician, in graded doses in a careful and controlled environment. A vaccine manufactured by Baxter is made without using eggs, but requires two doses three weeks apart to produce immunity [11].

Schools: The swine flu outbreak has led to numerous precautionary school closures in several countries. Rather than closing schools, the CDC recommended in August that students and school workers with flu symptoms should stay home for either seven days total, or until 24 hours after symptoms subside—whichever is longer. The CDC also recommended that colleges should consider suspending fall 2009 classes if the virus begins to cause severe illness in a significantly larger share of students than last spring. They have additionally urged schools to suspend any rules, including penalizing late papers or missed classes, or requiring a doctor's note, to enforce "self-isolation" and prevent students from venturing out while ill; schools were advised to set aside a room for people developing flu-like symptoms while they wait to go home and that surgical masks be used for ill students or staff and those caring for them [12-13].

Facial masks: The CDC does not recommend use of face masks or respirators in non-health care settings, such as schools, workplaces, or public places, with a few exceptions: people who are ill with the virus should consider wearing one when around other people, and people who are at risk for severe illness while caring for someone with the flu. There is some disagreement about the value of wearing either facial masks, some experts fearing that masks may give people a false sense of security and should not replace other standard precautions. Masks may benefit people in close contact with infected persons but it was unknown whether they prevent swine flu infection.

Quarantine: Countries have initiated quarantines or have threatened to quarantine foreign visitors suspected of having or being in contact with others who may have been infected. In May, the Chinese government confined 21 US students and three teachers to their hotel rooms. As a result, the US State Department issued a travel alert about China's anti-flu measures and warned travelers about traveling to China if ill. In Hong Kong, an entire hotel was quarantined with 240 guests; Australia ordered a cruise ship with 2,000 passengers to stay at sea because of a swine flu threat. Egyptian Muslims who went on the annual pilgrimage to Mecca risked being quarantined upon their return. Russia and Taiwan said they would quarantine visitors with fevers who come from areas where the flu is present. Japan quarantined 47 airline passengers in a hotel for a week in mid-May, and then in mid-June India suggested pre-screening "outbound" passengers from countries thought to have a high rate of infection [14].

Pigs and food safety: The pandemic virus is a type of swine influenza, derived originally from a strain that lived in pigs and this origin gave rise to the common name of "swine flu". This term is widely used by mass media. The virus has been found in American and Canadian hogs, as well as in hogs in Northern Ireland, Argentina, and Norway. However, despite its origin in pigs, this strain is transmitted between people and not from swine to people. The United States Secretary of Agriculture made clear that despite its common name being "swine flu", there is no risk of contracting flu from eating cooked pork products. Nevertheless, on April 27, Azerbaijan imposed a ban on the importation of animal husbandry products from America. The Indonesian government also halted the importation of pigs and initiated the examination of 9 million pigs in Indonesia. The Egyptian government ordered the slaughter of all pigs in Egypt on April 29, 2009.

Treatment

A number of methods have been recommended to help ease symptoms, including adequate liquid intake and rest. Over-the-counters pain medications such as acetaminophen and ibuprofen may also be useful to reduce symptoms. These measures however do not kill the virus. Most people recover without medical attention, although those with pre-existing or underlying medical conditions are more prone to complications and may benefit from further treatments.

Antivirals

People in at-risk groups should be treated with antivirals (oseltamivir or zanamivir) as soon as possible when they first experience flu symptoms. The at risk groups includes pregnant women, children under 2 years old, and people with ‘underlying conditions' such as respiratory problems. People who are not from the at-risk group who have persistent or rapidly worsening symptoms should also be treated with antivirals. These symptoms include difficulty breathing and a high fever that lasts beyond 3 days. People who have developed pneumonia should be given both antivirals and antibiotics, as in many severe cases of H1N1-caused illness, bacterial infection develops. Antivirals are most useful if given within 48 hours of the start of symptoms and may improve outcomes in hospitalized patients. In those beyond 48 hours who are moderately or severely ill antiviral may still be beneficial. If oseltamivir (Tamiflu) is unavailable or cannot be used zanamivir (Relenza) is recommended as a substitute. Peramivir is an experimental antiviral drug approved for hospitalized patients in cases where the other available methods of treatment are ineffective or unavailable. To help avoid shortages of these drugs, the CDC recommended oseltamivir treatment primarily for people hospitalized with pandemic flu; people at risk of

serious flu complications due to underlying medical conditions; and patients at risk of serious flu complications. The CDC warned that the indiscriminate use of antiviral medications to prevent and treat influenza could ease the way for drug-resistant strains to emerge which would make the fight against the pandemic that much harder. In addition, a British report found that people often failed to complete a full course of the drug or took the medication when not needed.

Side effects

Both medications have known side effects, including lightheadedness, nausea, vomiting, loss of appetite, and trouble breathing. Children were reported to be at increased risk of self-injury and confusion after taking oseltamivir. The WHO warns against buying antiviral medications from online sources, and estimates that half the drugs sold by online pharmacies without a physical address are counterfeit.

Resistance

As of December 2009[update], the World Health Organization (WHO) reported 96 out of over 10,000 samples of the prevalent 2009 pandemic H1N1 (swine) flu tested worldwide have shown resistance to oseltamivir (Tamiflu). This is not totally unexpected as 99.6% of the seasonal H1N1 flu strains tested have developed resistance to oseltamivir. No circulating flu has yet shown any resistance to zanamivir (Relenza), the other available anti-viral [15].

Pandemic	Year	Influenza virus type	People infected (approx)	Deaths worldwide (est.)	Case fatality rate
Spanish flu	1918–1919	A/H1N1	33% (500 million)	20–100 million	>2.5%
Asian flu	1956–1958	A/H2N2	?	2 million	<0.1%
Hong Kong flu	1968–1969	A/H3N2	?	1 million	<0.1%
Seasonal flu	Every year	mainly A/H3N2, A/H1N1, and B	5–15% (340 million –1 billion)	250,000–500,000 per year	<0.1%
Swine flu	2009	Pandemic H1N1/09	>526,060	9,797 (confirmed; ECDC) ≥6,770 (WHO)	?

CONCLUSION

The influenza virus has also caused several pandemic threats over the past century, including the Pseudopandemic of 1947 (thought of as mild because although globally distributed, caused reletively few deaths), the 1976 swine flu outbreak, and the 1977 Russian flu, all caused by the H1N1 subtype. The world has been at an increased level of alert since the SARS epidemic in Southeast Asia (caused by the SARS coronavirus). 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. People who contracted flu before 1957 appeared to have some immunity to swine flu. Dr. Daniel Jernigan of the CDC has stated: "Tests on blood serum from older people showed that they had antibodies that attacked the new virus [...] that does not mean that everyone over 52 is immune, since Americans and Mexicans older than that have died of the new flu."

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