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RESEARCH ARTICLE

SWINE FLU – AN EPIDEMIOLOGICAL PERSPECTIVE

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ABSTRACT

Swine influenza is a contagious disease that is caused by the influenza virus. The influenza virion, RNA enveloped virus consist of glycoprotein named HA (hemagglutinin) and NA (neuraminidase). Swine flu produces almost the same symptoms in pigs, as human flu produces in people. Infection with the H1N1 influenza virus can result in severe illness and life-threatening complications in human beings. The most common cause of death is respiratory failure. Although swine influenza is rarely fatal to pigs but fatalities are more common in children and elderly people. The CDC recommends real time RT-PCR as the method of choice for diagnosing H1N1. In the year 2009, WHO raised the worldwide pandemic alert level to phase- 6 for swine flu, which is the highest alert level. A little treatment beyond rest and supportive care is required in case of pigs However, in human beings if the patient is tested positive for swine flu, treatment needs to be initiated immediately. The anti-viral medicines oseltamivir (Tamiflu/Fluvir) and zanamivir (Relenza) are recommended. Swine flu is very contagious in nature hence the vaccination and strict import controls are the only specific preventive measure. Good sanitary and hygienic practices, freedom from stress particularly due to crowding and dust help to reduce losses.

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INTRODUCTION

Swine flu (swine influenza) is a respiratory disease caused by viruses (influenza viruses) that infect the respiratory tract of pigs, resulting in nasal secretions, a barking cough, decreased appetite and listless behavior. Swine flu produces almost the same symptoms in pigs, as human flu produces in people. Swine flu can last about one to two weeks in pigs that survive (Alexander, 1982). Swine influenza virus was first isolated from pigs in 1930 in the U.S. and has been recognized by pork producers and veterinarians to cause infections in pigs worldwide. In a number of instances, people have developed the swine flu infection when they are closely associated with pigs (for example, farmers, pork processors), and likewise, pig populations have occasionally been infected with the human flu infection. In most instances, the cross-species infections (swine virus to man; human flu virus to pigs) have remained in local areas and have not caused national or worldwide infections in either pigs or humans (Heinen, 2003). Unfortunately, this cross-species situation with influenza viruses has had the potential to change.

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Investigators decided that the 2009 so-called "swine flu" strain, first seen in Mexico, should be termed novel H1N1 flu since it was mainly found infecting people and exhibits two main surface antigens, H1 (hemagglutinin type 1) and N1 (neuraminidase type1). The eight RNA strands from novel H1N1 flu have one strand derived from human flu strains, two from avian (bird) strains, and five from swine strains.

Structure of Virus

The influenza virion is roughly spherical. It is RNA enveloped virus belongs to family Orthomyxoviridae; the outer layer is a lipid membrane which is taken from the host cell in which the virus multiplies. Inserted into the lipid membrane are 'spikes', which are proteins – actually glycoproteins, because they consist of protein linked to sugars – known as HA (hemagglutinin) and NA (neuraminidase). These are the proteins that determine the subtype (A/H1N1) of influenza virus (Webster *et al.,* 1992).

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 (Bouvier and Palese, 2008). 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.

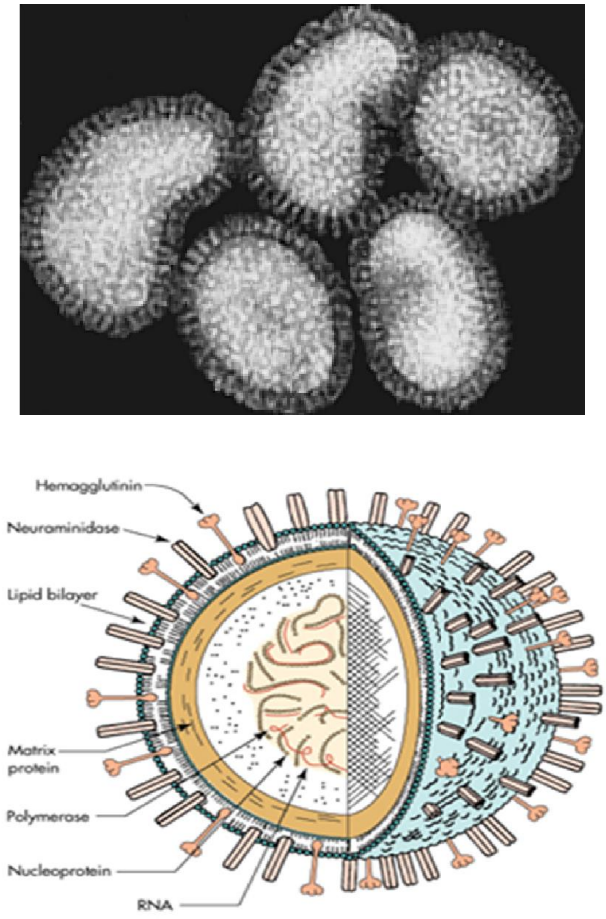

Fig. 1. Electron microscope image of the H1N1 influenza virus

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.

Nomenclature

This virus was originally referred to as "swine flu" because laboratory testing showed that many of the genes in the virus were very similar to influenza viruses that normally occur in pigs (swine) in North America. But further study have shown that the 2009 H1N1 is very different from what normally circulates in North American pigs. It has two genes from flu viruses that normally circulate in pigs in Europe and Asia and bird (avian) genes and human genes. Scientists call this a "quadruple re-assortment" virus.

- The CDC has shifted the nomenclature "novel H1N1" to "2009 H1N1 Flu" (Times of India, 2015)
- In the Netherlands it was originally called "pig flu" but is now called "Mexican flu" by the National Health Institute.
- Taiwan suggested the names "H1N1 flu" or "new flu", which most local media adopted.
- The World Organization for Animal Health proposed the name "North American influenza".
- The European Commission adopted the term "novel flu virus".

In August 2010, the World Health Organization declared the swine flu pandemic officially over.

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 (Knobler *et al*., 2005). The first identification of an influenza virus as a cause of disease in pigs occurred about ten years later, in 1930 (Olsen, 2002). 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 re-assortment from human, swine and avian viruses, have become a major cause of swine influenza in North America. Re-assortment 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. 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 recorded 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.

1918 pandemic in humans

The 1918 flu pandemic in humans was associated with H1N1 and influenza appearing in pigs (Taubenberger and Morens, 2006). 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 suggested 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 suggested that the 1918 outbreak in humans followed a re-assortment event within a mammal, the exact origin of the 1918 strain remains elusive (Antonovics *et al.*, 2006) It is estimated that anywhere from 50 to 100 million people were killed worldwide.

1976 U.S. outbreak

In 1976, in US at Fort Dix few soldiers were reported to be suffered from H1N1 but it did not spread beyond Fort Dix.

1988 Zoonosis

In September 1988, a swine flu virus killed one woman and infected others. The only pathogen identified was an H1N1 strain of swine influenza virus. 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. 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 was 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 they tested negative for the swine flu virus.

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 have 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 2009, 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 new strain was initially described as an apparent re-assortment 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 re-assortment 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 re-assortment 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 (Choffnes *et al.*, 2010). The 2009 swine flu has been compared to other similar types of influenza virus in terms of mortality. The fatality rate was not as high as at first feared, although as of 4 April 2010, towards the end of the 2009/10 flu season, at least 17,700 deaths worldwide were attributed to the strain. April 2010, a review of the global response to the 2009 H1N1 pandemic was launched. On June 11, 2009 the WHO raised the worldwide pandemic alert level to phase- 6 for swine flu, which is the highest alert level.

2009 Flu Pandemic in India

- The first case of the flu in India was found on the Hyderabad airport on 13 May, when a man traveling from US to India was found H1N1 positive.
- The first death due to swine flu in India in Pune, and panic began to spread**.**

Table 1. The normal burden of H1N1 in India

S.No.	Year	Human Death
1	2009	981
2	2010	1763
3	2011	75
4	2012	405
5	2013	699
6	2014	218
7	2015 (March 30, 2015)	2035

(BBC News, 2015 and DNA India, 2015)

Transmission

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 an infected animal poses no risk of infection when properly cooked.

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 increases 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 transmission through the aerosols produced by pigs coughing or sneezing is also an important means of infection. The virus usually spreads quickly through a herd, infecting all the pigs with in 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 re-assortment can co-occur (Myers *et al*., 2007). 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 amongst others form the basis of a recommendation that people whose jobs involve handling poultry and swine be the focus of increased public health surveillance.

Transmission between human to human

Swine flu is very contagious. The disease spreads through saliva and mucus particle. Transmitted from person to person by inhalation or ingestion of droplets containing virus from people sneezing or coughing; it is not transmitted by eating cooked pork products. The newest swine flu virus that has caused swine flu is influenza A H3N2v (commonly termed H3N2v) that began as an outbreak in 2011. The "v" in the name means the virus is a variant that normally infects only pigs but has begun to infect humans.

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 (Yassine*et al*., 2007). 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.

Risk Factor

Other professionals who 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.

Since swine flu can directly be transmitted from one person to another through air droplets, people who fail to follow proper hygiene, especially in crowded places are at a high risk of contracting the virus. But, according to observations, there are specific groups of individuals that have been most affected by the illness.

The group at a high risk includes:

- Individuals having any other respiratory condition like pneumonia
- Pregnant women
- People suffering from chronic diseases like heart disease and diabetes
- People more than 65 years of age and children younger than 2 years

- **Humidity 35-40%, Temperature 28^0C (82^0F) Incubation Period**

After exposure, individual will come down with swine flu symptoms in 1 to 4 days. The longest incubation period is thought to be 7 days.

Signs and Symptoms

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%),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.

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 medical literature in 1958, which have resulted in a total of six deaths. Of these six people, one was pregnant, one had leukemia, one had Hodgkin disease and two were known to be previously healthy (Hampson and Mackenzie, 2006). 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.

According to the Centers for Disease Control and Prevention (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 was not zoonotic swine flu, as it was not transmitted from pigs to humans, but from person to person. The most common cause of death was respiratory failure. Other causes of death were pneumonia (leading to sepsis), high fever (leading to neurological problems), dehydration (from excessive vomiting and diarrhea), electrolyte imbalance and kidney failure. Fatalities were more common in young children and the elderly. Research carried out at Imperial College London has shown that, unlike seasonal flu, H1N1/09 can infect cells deep in the lungs. Seasonal flu can only infect cells with receptor type a2-6 which are typically located in the nose and throat but H1N1/09 can also infect cells with receptor type a2-3. This may explain why some patients experience severe respiratory symptoms.

Diagnosis

The CDC recommend 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. Although influenza is usually diagnosed on the basis of clinical symptoms, the gold standard laboratory test is the 14 day culture. However, the test results take too long and hence, are not often done.

New swine flu kit makes disease detection easier in India

With the threat of swine flu looming large over the country again, the Defence Research and Development Organisation (DRDO) has brought out a cheaper, more effective kit to diagnose the disease. The portable testing kit, Nu-Lamp H1N1, can give the results of the test within an hour. The technology used in the kit has now been handed over to a Hyderabad-based private company, RAS Lifesciences Private Limited, for commercialising. The DRDO will approach the Indian Council of Medical Research, health ministry and NDMA for wider use of the new kit. "If the government decides to scale up the technology, the cost can come down to Rs. 400 per test" (Express News Service, 2012).

Bio safety guideline for laboratory workers

Diagnostic work on clinical samples from patients who are suspected cases of swine influenza A (H1N1) virus infection should be conducted in a BSL-2 laboratory

- All sample manipulations should be done inside a biosafety cabinet (BSC)
- Viral isolation on clinical specimens from patients who are suspected cases of swine influenza A (H1N1) virus infection should be performed in a BSL-2 laboratory with BSL-3 practices (enhanced BSL-2 conditions)
- Appropriate disinfectants 70 per cent ethanol or 5 per cent Lysol or 10 per cent bleach
- Any illness should be reported to your supervisor immediately
- For personnel who had unprotected exposure or a known breach in personal protective equipment to clinical material or live virus from a confirmed case of swine influenza A (H1N1), antiviral chemoprophylaxis with Zanamivir or Oseltamivir for 7 days after exposure can be considered.

Treatment

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.

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.

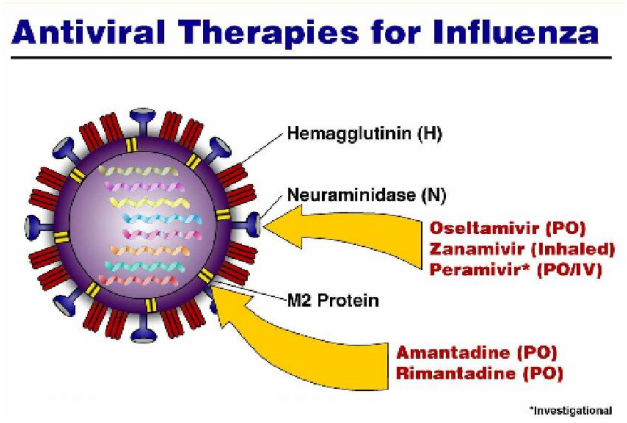

Table 2. Therapeutic and prophylactic anti-viral medications for Swine flu

	Oseltamivir (Tamiflu)		Zanamivir (Relenza)	
	Treatment	Prophylaxis	Treatment	Prophylaxis
Adults	75 mg capsule twice per day for 5 days	75 mg capsule once per day	Two 5 mg inhalations (10 mg total) twice per day	Two 5 mg inhalations (10 mg total) once per day
Children	15 kg or less: 60 mg per day divided into 2 doses 15–23 kg: 90 mg per day divided into 2 doses 24–40 kg: 120 mg per day divided into 2 doses >40 kg: 150 mg per day divided into 2 doses	30 mg once per day 45 mg once per day 60 mg once per day 75 mg once per day	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)

Table 3. Swine flu precautions Guidelines by the Government of India

Category	symptoms	Test	Tamiflu	Advice
A	Mild fever, sore throat, runny nose, cough, body ache and other flu like symptoms	No	No	Stay home Review after 48 hours
B1	High fever, severe sore throat, cold and flu like symptoms	No	Yes	Stay home until Treatment is complete
B2	Above symptoms in immunosuppressive conditions, Children, pregnant women, chronic Lung diseases and asthma	No	Yes	Stay home, will be monitored by doctors
C	Breathlessness, chest pain Drowsiness, blood streaked sputum, high BP	Yes	Yes	Hospitalize

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.

Prevention

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

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. 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.

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 two weeks, except in cold (but above freezing) conditions and it is readily inactivated by disinfectants. 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. After an outbreak, as immunity in exposed pigs wanes, new outbreaks of the same strain can occur in humans.

Prevention of pig to human transmission

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 (Van Reeth, 2007). 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 especially, not wearing gloves when working with sick animals, thereby increasing the likelihood of subsequent hand-to-eye, hand-to-nose or hand-to-mouth transmission.

Prevention of human to human transmission

Influenza spreads between humans when infected people cough or sneeze, then other people breathe in the virus or touch something with the virus on it and then touch their own face. 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 not touching your eyes, nose or mouth with your hands helps to prevent the 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 eyes, nose or mouth. 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.

- Avoid over crowded places like picnic spots, shopping malls, restaurants etc.
- Use medicated facemask (N-95 mask) while going out.
- Keep at least 6 feet gap from person sneezing or suffering from bad cough as germs in air can infect you.
- Be cautious while touching or using unhygienic public facilities like toilets, roadside food etc.
- Use sanitizer and frequently wash hands with soap after visiting public places.
- Pregnant women must avoid going to public places, as they are more prone to Swine Flu.
- Consult doctor immediately if cough and cold prevails for long duration. Infected person must visit doctor without hesitation.

While some of the Ayurvedic medicines like *Kadha* (prepared by boiling herbs in water) is also a good way to increase your immunity against this disease. Now days, many organizations are distributing them free of cost.

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) showed that a single dose creates enough antibodies to protect against the virus within about 10 days. H1N1 vaccine available in market are- Influvac, Agrippal, Vaxigrip, Vaxiflu-s and Fluarix.

- Vaxiflu-S (ZydusCadila) It is a single shot intra-muscular vaccine against H1N1 virus and costs Rs 350.
- The country's first intra-nasal vaccine 'Nasovac' was released by Pune's Serum Institute of India on July 5. Nasovac, meant for Type A H1N1 pandemic strain, is a nasal spray in powder form, which has to be reconstituted by adding water. One dose costs Rs 200.

REFERENCES

Alexander, D.J. 1982. Ecological aspects of influenza a viruses in animals and their relationship to human influenza: a review. *Journal of the Royal Society of Medicine,* 75 (10): 799–811

Antonovics, J., Hood, M.E. and Baker, C.H. 2006. Molecular virology: was the 1918 flu avian in origin?. *Nature,* 440

BBC News (2015). India struggles with deadly swine flu outbreak. (http://.www.bbc.com). Retrived 21 February, 2015

Bouvier, N.M. andPalese, P. 2008. The biologyof influenza viruses.*Vaccine*. 26 (4): 49–53

Choffnes, Eileen R., Alison, M. and David, A. Relman 2010. The Domestic and international impacts of the 2009-H1N! Influenza a Pandemic: Global Challenges, Global Solutions: Workshop Summary. Washington, D.C.: National Academies.

DNA India 2015. DRDO's swine flu detection kit likely to hit market in three months. (http://.www.dnaindia.com). Retrived 13 March, 2015

Express News Service 2012. Swine flu: Toll reaches 1857 as study warns of virus mutation in Indian strain (http://archive.indianexpress.com). Retrived 04 April, 2012.

Hampson, A.W. and Mackenzie, J.S. 2006. The influenza virus. *The Medical Journal of Australia* 185 (10): 39–43

Heinen, P. 2003. Swine influenza: a zoonosis. *Veterinary Science Tomorrow*. 1: 11

Knobler, S., Mack, A., Mahmoud, A. and Lemon, S. 2005. TheStory of Influenza.The Threat of Pandemic Influenza: Are We Ready?Workshop Summary Washington,D.C.: *The National Academies Press*. p. 75.

Myers, K.P., Olsen, C.W. and Gray, G.C. 2007. Cases of Swine Influenza in Humans: A Review of the Literature. *Clinical Infectious Diseases* 44 (8): 1084–8

Olsen, C.W. 2002. The emergence of novel swineinfluenza viruses in North America.*Virus Research.*85 (2): 199–210

Taubenberger, J.K. andMorens, D.M. 2006. 1918 Influenza:the mother of all pandemics. *Emerging Infectious Diseases,*12 (1):15–22.

Times of India 2015. It's H1N1 pandemic influenza 2009, not swine flu. (http://.www.timesofindia.indiatimes.com). Retrived 22 February, 2015

Van Reeth, K. 2007. Avian and swine influenza viruses: our current understanding of the zoonotic risk. *Veterinary Research,* 38 (2): 243–60

Webster, R.G., Bean, W.J., Gorman, O.T., Chambers, T.M. and Kawaoka, Y. 1992. Evolution and ecology of influenza A viruses. *Microbiological Reviews,* 56 (1): 152–79.

Yassine, H.M., Al-Natour, M.Q., Lee, C.W. and Saif, Y.M. 2007. Interspecies and intraspecies transmission of triple reassortantH3N2 influenza A viruses. *Virology Journal*. 4: 129.

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