GLOBAL THREAT OF SWINE FLU: A REVIEW

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Summary

Swine flu is one of the deadly disease today worldwide which is caused because of many different strains of H1N1 virus. The virus is mutant strain found of pigs and avian and can be transmitted from them to humans. First case of swine flu was reported in 1918. Part of the process that allows influenza viruses to invade cells is the cleavage of the viral hemagglutinin protein by any one of several human proteases. In mild and virulent viruses, the structure of the hemagglutinin means that it can only be cleaved by proteases found in the throat and lungs, so these viruses cannot infect other tissues. The diagnosis of *confirmed* swine flu requires laboratory testing of a respiratory sample of simple nose throat swab, and eyes. Vaccines may be available for different kinds of swine Flu in near future. Present Treatment includes antiviral drugs especially oseltamivir
(Tamiflu) and Zanamivir (Relenza). However immunity of individual is of much importance.

Key words: H1N1 flu, Swine flu, Hog flu, throat swab and Pig flu

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Introduction

Swine influenza is an infection by any one of several types of swine influenza virus. **Swine influenza virus** (**SIV**) is any strain of the influenza family of viruses that is endemic in pigs.[1] 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 an infected animal poses no risk of infection when properly cooked. 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 [2].

HISTORY

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. 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 [3,4].
1976 U.S. outbreak	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[5, 6]
1988 Zoonosis	Influenza-like illness (ILI) was reportedly widespread among the pigs exhibited at the fair. 76% of 25 swine exhibitors aged 9 to 19 tested positive for antibody to SIV, but no serious illnesses were detected among this group. [7, 8]
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 [9,10,11].

2007 Philippine outbreak in swine	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. [12, 13]
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. But further research has shown that the outbreak is due to a new strain of H1N1 not previously reported in pigs. 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. [14, 15, 16,17]

Table no. - 1 History of swine flu

LIFE CYCLE OF SWINE FLU[18]

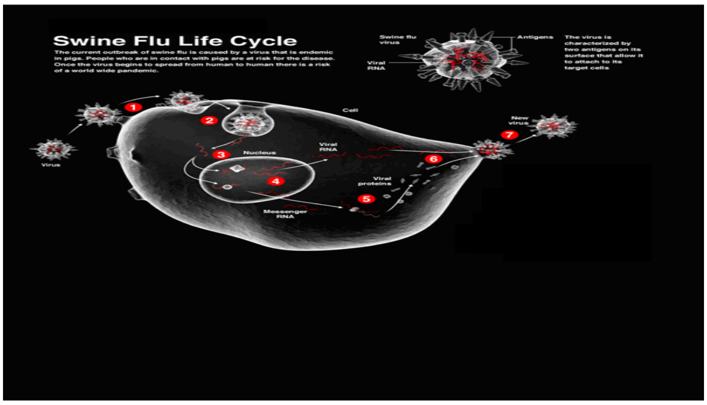


Fig.no.-1 Life cycle of Swine flu

The virus uses its antigens to attach to the surface cells in the nose, throat and lungs.

1. The cells engulf the virus.
2. The virus is able to pierce the bubble of cell membrane that encloses it and release its RNA cargo into the cell.
3. In the nucleus copies of viral RNA are made.
4. Viral messenger RNA causes the cell to make viral proteins.
5. These proteins and RNA migrate to the cell’s surface where they are assembled into new virus
6. These proteins and RNA migrate to the cell’s surface where they are assembled into new virus particles.
7. New virus starts budding off from the cell surface.

PATHOPHYSIOLOGY

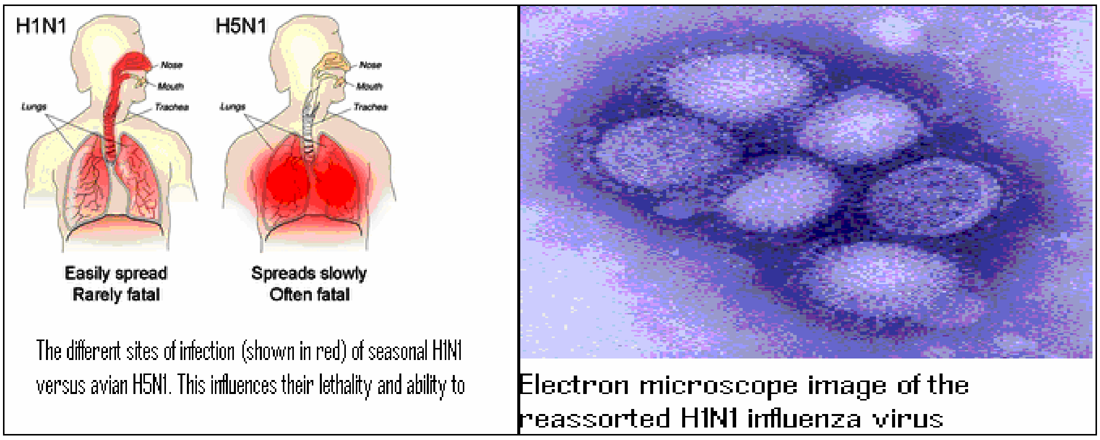


Fig. no. - 2 Pathophysiology

The mechanisms by which influenza infection causes symptoms in humans have been studied intensively. Consequently, knowing which genes are carried by a particular strain can help predict how well it will infect humans and how severe this infection will be (that is, predict the strain's pathophysiology). [19, 20] For instance, part of the process that allows influenza viruses to invade cells is the cleavage of the viral hemagglutinin protein by any one of several human proteases. [21] In mild and avirulent viruses, the structure of the hemagglutinin means that it can only be cleaved by proteases found in the throat and lungs, so these viruses cannot infect other tissues. However, in highly virulent strains, such as H5N1, the hemagglutinin can be cleaved by a wide variety of proteases, allowing the virus to spread throughout the body.[20]The viral hemagglutinin protein is responsible for determining both which species a strain can infect and where in the human respiratory tract a strain of influenza will bind.[22]Strains that are easily transmitted between people have hemagglutinin proteins that bind to receptors in the upper part of the respiratory tract, such as in the nose, throat and mouth. In contrast, the highly-lethal H5N1 strain binds to receptors that are mostly found deep in the lungs.[23]This difference in the site of infection may be part of the reason why the H5N1 strain causes severe viral pneumonia in the lungs, but is not easily transmitted by people coughing and sneezing. [24, 25]Common symptoms of the flu such as fever, headaches, and fatigue are the result of the huge amounts of proinflammatory cytokines and chemokines (such as interferon or tumor necrosis factor) produced from influenza-infected cells.[26]In contrast to the rhinovirus that causes the common cold, influenza does cause tissue damage, so symptoms are not entirely due to the inflammatory response.[27] This massive immune response might produce a life-threatening cytokine storm. This effect has been proposed to be the cause of the unusual lethality of both the H5N1 avian influenza, [28] and the 1918 pandemic strain. [29,30] However, another possibility is that these large amounts of cytokines are just a result of the massive levels of viral replication produced by these strains, and the immune response does not itself contribute to the disease. [31]

WORLD LAB-VERIFIED SWINE FLU INFECTIONS [32,33,34,35,36]

Country	Cases	Deaths	Country	Cases	Deaths	Country	Cases	Deaths
Afghanistan	32	0	Georgia	44	1	Nepal	30	0
Akrotiri & Dhekelia	34	0	Germany	11493	0	Netherlands	1473	1
Albania	13	0	Ghana	2	1	New Zealand	3034	17
Algeria	20	0	Gibraltar	3	0	Nicaragua	553	1
Antigua & Barbuda	4	0	Greece	1424	0	North Korea	7	0
Argentina	6768	404	Grenada	2	0	Norway	868	0
Aruba	13	0	Guam	139	1	Oman	287	0
Australia	28987	102	Guatemala	558	10	Pakistan	2	0
Austria	222	0	Guernsey	17	0	Palestinian	104	1
Azerbaijan	2	0	Guyana	8	0	Panama	629	4
Bahamas	29	0	Haiti	5	0	Paraguay	244	27
Bahrain	148	0	Honduras	267	7	Peru	5743	45
Bangladesh	36	0	Hungary	133	1	Philippines	3207	10
Barbados	39	0	Iceland	118	0	Poland	282	0
Belgium	126	1	India	1390	28	Portugal	1061	0
Bermuda	8	0	Indonesia	838	5	Puerto Rico	135	12
Bhutan	6	0	Iran	196	0	Qatar	350	1
Bolivia	1111	14	Iraq	96	1	Romania	238	0
Bosnia & Herzegovina	10	0	Ireland	574	1	Russia	55	0
Botswana	23	0	Israel	2148	8	Samoa	100	2
Brazil	3642	277	Italy	1238	0	Saudi Arabia	595	11
British Virgin Islands	8	0	Jamaica	64	4	Serbia	123	0
Brunei	850	1	Japan	5022	0	Singapore	1217	11
Bulgaria	51	0	Jersey	55	0	Slovakia	92	0
Cambodia	24	0	Jordan	99	0	Slovenia	196	0
Canada	11976	67	Kazakhstan	17	0	South Africa	1910	3
Cape Verde	24	0	Kenya	26	0	South Korea	1754	0
Cayman Islands	97	1	Kosovo	9	0	Spain	1806	10
Chile	12104	105	Kuwait	740	0	Sri Lanka	63	0
China (Hong Kong)	6640	4	Laos	156	1	St. Kitts	4	1
China (Mainland)	2350	1	Latvia	22	0	Sudan	2	0
Colombia	298	18	Lebanon	476	1	Suriname	18	0
Cook Islands	18	0	Libya	9	0	Swaziland	2	0

Costa Rica	865	29	Lithuania	40	0	Sweden	602	0
Croatia	71	0	Luxembour g	113	0	Switzerland	726	0
Cuba	264	0	Macau	339	0	Syria	16	0
Cyprus	297	0	Madagasca r	1	1	Taiwan	1280	1
Czech Republic	201	0	Malaysia	2253	56	Tanzania	15	0
Denmark	444	0	Maldives	2	0	Thailand	11585	97
Dominica	1	0	Malta	204	0	Turkey	324	0
Dominican Republic	182	5	Mauritius	30	3	Ukraine	1	0
Ecuador	881	22	Mexico	18861	163	UAE	125	0
Egypt	402	1	Micronesia	1	0	United Kingdo m	12903	49
El Salvador	634	12	Moldova	2	0	Uruguay	550	25
Estonia	56	0	Monaco	1	0	Venezuela	568	12
Ethiopia	4	0	Montenegr o	18	0	Vietnam	1300	2
Fiji	97	0	Morocco	78	0	Yemen	26	0
Finland	196	0	Myanmar	19	0	Zambia	5	0
France	1125	1	Namibia	10	0	Zimbabwe	2	0
French Guiana	3	0	Nauru	7	0	**Total Count:**	**187015**	**1701**

Table no. 2- World Lab-Verified Swine Flu Infections

DEATH RATE PER INFECTION [37, 38,39,40,41]

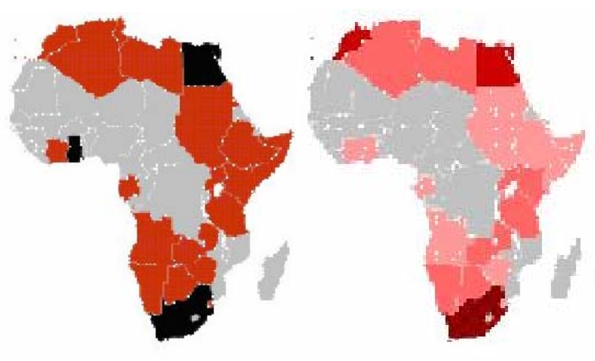
Country	**Cases**	**Deaths**	**% Dead**	**Country**	**Cases**	**Deaths**	**% Dead**
Madagascar	1	1	100%	Chile	12104	105	0.87%
Ghana	2	1	50%	Mexico	18861	163	0.86%
St. Kitts	4	1	25%	Thailand	11585	97	0.84%
Tonga	9	1	11.11%	Belgium	126	1	0.79%
Paraguay	244	27	11.07%	Peru	5743	45	0.78%
Mauritius	30	3	10%	Guam	139	1	0.72%
Puerto Rico	135	12	8.89%	Laos	156	1	0.64%
Brazil	3642	277	7.61%	Panama	629	4	0.64%
Jamaica	64	4	6.25%	Indonesia	838	5	0.60%
Colombia	298	18	6.04%	New Zealand	3034	17	0.56%
Argentina	6768	404	5.97%	Canada	11976	67	0.56%
Uruguay	550	25	4.55%	Spain	1806	10	0.55%
Costa Rica	865	29	3.35%	UK	12903	49	0.38%

Dominican Republic	182	5	2.75%	Israel	2148	8	0.37%
Honduras	267	7	2.62%	Australia	28987	102	0.35%
Ecuador	881	22	2.50%	Philippines	3207	10	0.31%
Malaysia	2253	56	2.49%	Qatar	350	1	0.29%
Georgia	44	1	2.27%	Egypt	402	1	0.25%
Venezuela	568	12	2.11%	Lebanon	476	1	0.21%
India	**1390**	**28**	**2.01%**	Nicaragua	553	1	0.18%
Samoa	100	2	2%	Ireland	574	1	0.17%
El Salvador	634	12	1.89%	South Africa	1910	3	0.16%
Saudi Arabia	595	11	1.85%	Vietnam	1300	2	0.15%
Guatemala	558	10	1.79%	Brunei	850	1	0.12%
Bolivia	1111	14	1.26%	France	1125	1	0.09%
Iraq	96	1	1.04%	Taiwan	1280	1	0.08%
Cayman Islands	97	1	1.03%	Netherlands	1473	1	0.07%
United States	48843	477	0.98%	China (Hong Kong)	6640	4	0.06%
Palestinian Territories	104	1	0.96%	China (Mainland)	2350	1	0.04%
Singapore	1217	11	0.90%	**Overall:**	**205210**	**2179**	**1.06%**

Table No. 3 - Death rate per infection

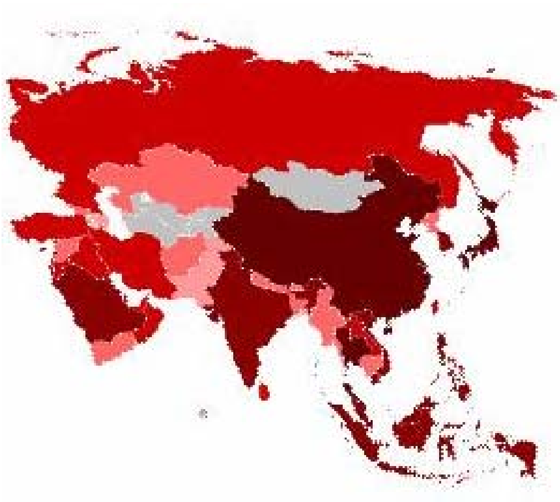
AFFECTED CONTINENTS/COUNTRIES

AFRICA [42, 43]



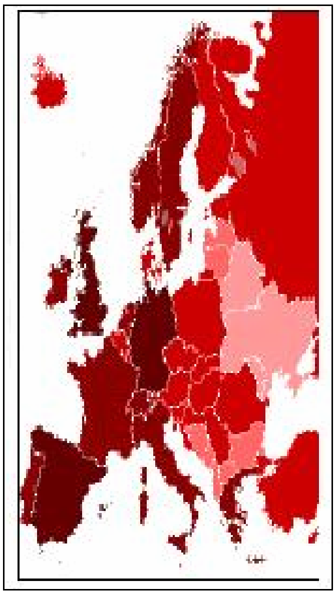
Outbreak evolution in Africa	**Outbreak evolution in Africa:**
Deaths	5000+confirmed cases
Confirmed cases	500+confirmed cases
Suspected cases	50+confirmed cases
No reported cases	5+confirmed cases
	1+ confirmed cases

ASIA [44, 45]



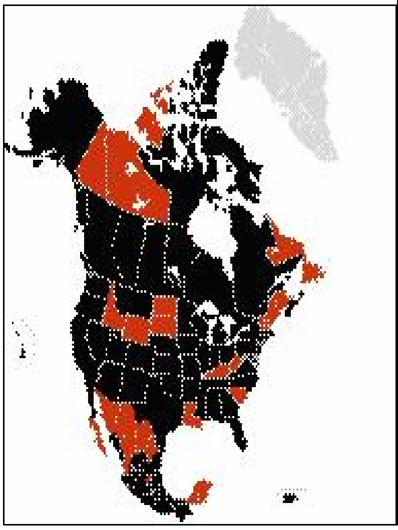
Number of confirmed cases of (H1N1) virus in Asia (as of 23 June 2009)	Cases of the (H1N1) virus in Asia
50 000+ cases	Deaths
5 000+ cases	Confirmed cases
500+ cases	Suspected cases
50+ cases	No reported cases
5+ cases	
1+ case	

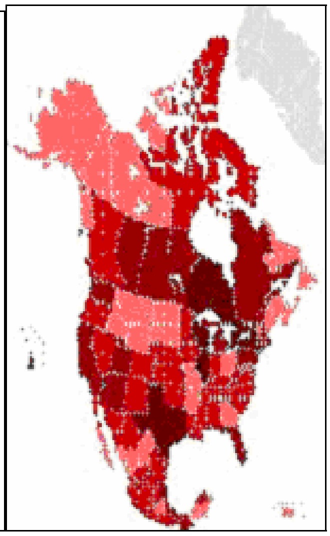
EUROPE: [46, 47]



Outbreak evolution in Europe	**Outbreak evolution in Europe**
Deaths	500+ cases
Confirmed cases	50+ cases
Suspected cases	5+ cases
No reported cases	1+ cases

NORTH AMERICA [48, 49]





Outbreak distribution in North America	**Outbreak distribution in North America**
Deaths	2000+ cases
Confirmed cases	500+ cases
	100+ cases
Suspected cases	1+ cases
No reported cases	

SOUTH AMERICA[50, 51]

Outbreak evolution in South America	**Outbreak evolution in South America**
Deaths	5000+ cases
Confirmed cases	500+ cases
	50+ cases
Suspected cases	5+ cases
No reported cases	1+ cases

TRANSMISSION

TRANSMISSION BETWEEN PIGS	TRANSMISSION TO HUMANS
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. [52] 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 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 within just a few days. Transmission may also occur through wild animals, such as wild boar, which can spread the disease between farms. [53]	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. [54] Other professions at particular risk of infection are veterinarians and meat processing workers,. [55]

Table no.3- Transmission of swine flu

SIGNS AND SYMPTOMS IN SWINE AND HUMAN

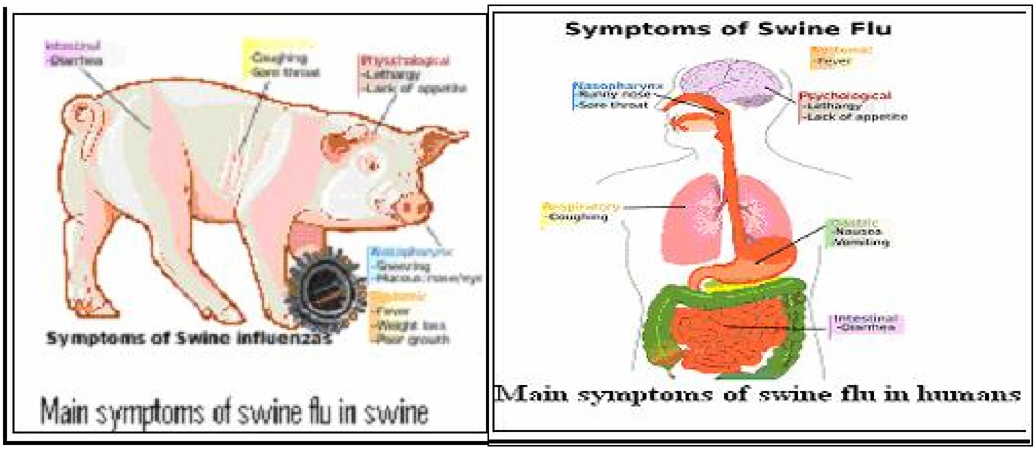


Fig. No. 2 - Signs and symptoms in swine and human

IN SWINE	IN HUMAN
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. [56]	Direct transmission of a swine flu virus from pigs to humans is occasionally possible (called zoonotic swine flu). 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. The most common cause of death is respiratory failure, other causes of death are pneumonia high fever (leading to neurological problems), dehydration (from excessive vomiting) and electrolyte imbalance. Fatalities are more likely in young children and the elderly. [57]

Table no. 4 - Signs and symptoms in swine and human

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	Prevention in humans	Prevention of human to human transmission
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	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. So farmers and veterinarians are encouraged to use a face mask when dealing with infected animals. The use of vaccines on swine to prevent	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

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. [58] 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. 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. [59]	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.[60]	specimen, collected during the first five days for analysis.prevention 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. Alcohol-based gel or foam hand sanitizers work well to destroy viruses and bacteria. [61]

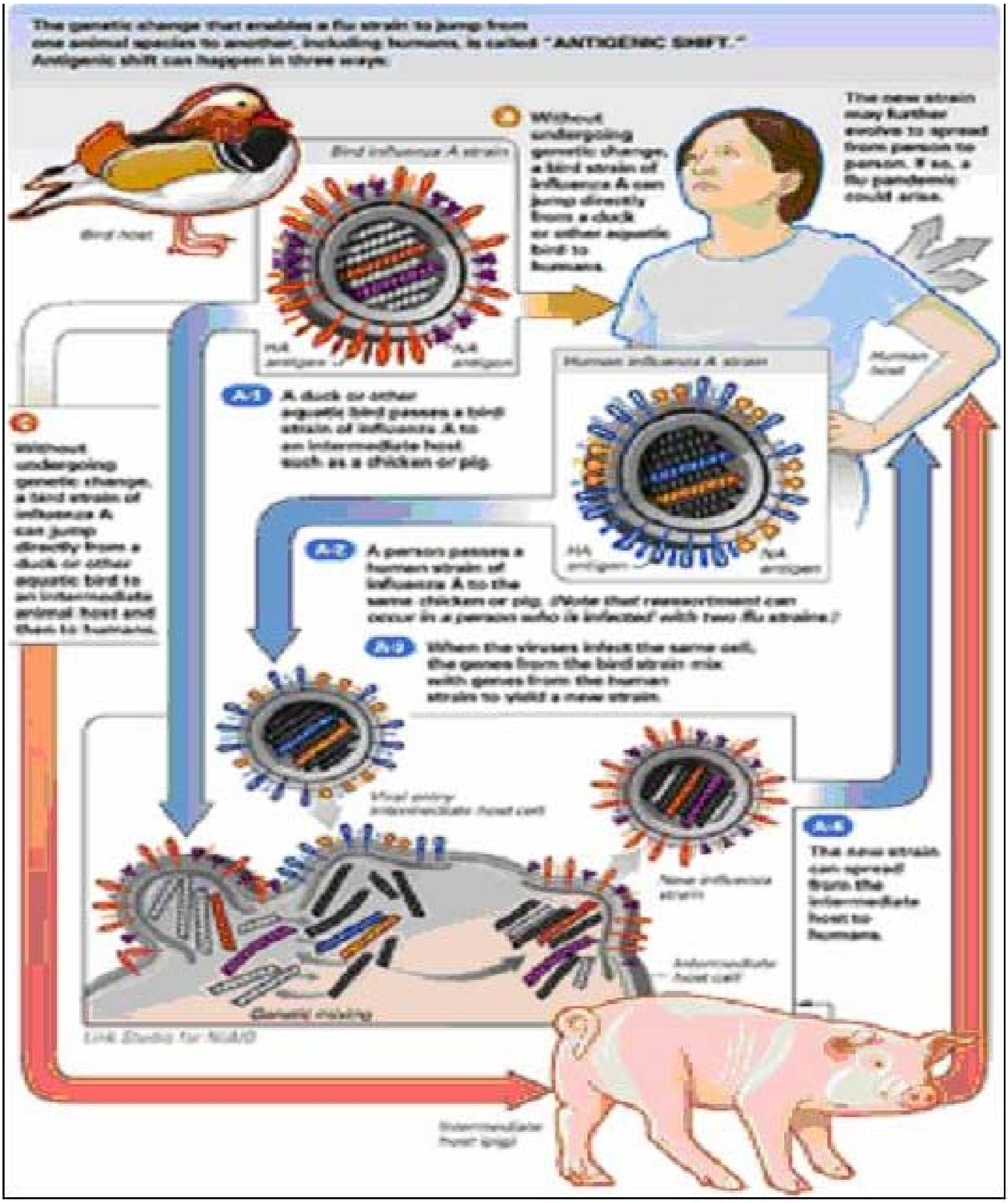


Fig. no. 4- Prevention of swine influenza

Table no. 5- Prevention of Swine flu

TREATMENT

IN SWINE	IN HUMAN
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. [52]	For treatment, antiviral drugs work best if started soon after getting sick (within 2 days of symptoms). Beside antiviral, 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. [62]

Table No. 6- Treatment of Swine flu

VACCINATION

Vaccines are available for different kinds of Swine Flu. Although the current trivalent influenza vaccine is unlikely to provide protection against the new 2009 H1N1 strain, vaccines against the new strain are being developed and could be ready as early as November 2009. [63]

CONCLUSION

Swine flu is considered to be the most dreadful disease. Whole world is under the threat for the high risk of H1N1 infection.H1N1 is the recombinant mutant strain of influenza A and swine. The structural dimension of these antigens to be found out. It is very essential to find the vaccine for these infection. The negligence of today may be high mortality tomorrow because of rearrangement of H1 and N1.In the present review we have highlighted the etiology of disease .The review is also useful to know the worldwide infection of H1N1 and the death rate. Hence we summarize, prevention is better than cure. Let us save the earth .Let us save the living being**.**

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