

Qualitative data analysis of H7N9 Virus or Asian Lineage Avian Influenza outbreak, its behavioral effects, and its remedial issues.

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Abstract:

H7N9 is a bird flu strain of the species Influenza virus A (Avian Influenza Virus or bird flu virus). Avian influenza A H7 viruses normally circulate amongst avian populations with some variants known to occasionally infect humans. An H7N9 virus was first reported to have infected humans in March 2013, in China.

However, since then, infections in both humans and birds have been observed. The disease is of concern because most patients have become severely ill. Most of the cases of human infection with this avian H7N9 virus have reported recent exposure to live poultry or potentially contaminated environments, especially markets where live birds have been sold. This virus does not appear to transmit easily from person to person, and sustained human-to-human transmission has not been reported.

This virus usually spreads due to unhygienic conditions prevailing amongst the people, like not maintaining the proper sanitary conditions in the poultry fields, severe exposure of this poultry to contaminated environment high risk of exposure to toxic chemicals and gases that led the poultries to be invaded by the virus then to the transmission to the humans by eating virus infected chicken meat, eggs, and poultry products.

This is a serious level of concern since it causes a huge epidemic of harmful life killing disease that may cause a serious threat to respiratory system and tracheal infections, bronchitis etc.

In most cases, infection with A (H7N9) virus is characterized by high fever, cough, shortness of breath and rapidly progressing severe pneumonia. Complications include acute respiratory distress syndrome (ARDS), septic shock and multi-organ failure requiring intensive care. Severe illness and fatal outcome have been more frequently observed in pregnant women, in older persons and those with underlying chronic conditions. Asymptomatic and mild infections with A(H7N9) virus have been detected, but the underlying rate of such infections is not well understood.

Introduction:

H7N9 flu or Asian Lineage Avian Influenza is an infection that occurs after exposure to infected poultry or contaminated environment. It was first reported in the year 2013, in china. The sickness being a major killer strikes mostly during the winter months. The WHO has identified H7N9 an unusually dangerous virus for humans. Most of the cases result in severe respiratory disorders with a mortality rate of roughly 40%.It is more prevalent among older males while several environmental and behavioral and biological explanations for this pattern have been proposed, the reasons remain unknown.

This case of H7N9 virus attack was first encountered in CHINA on 31 March 2013, the Chinese authorities had announced the identification of a novel influenza A virus, an A(H7H9) virus, in three people in Shanghai and Anhui province. Two men in Shanghai, 87 and 27 years old, respectively, had become ill with influenza like (ILI) symptoms and progressed to severe lower respiratory tract infections within a week in mid to late February, and died from acute respiratory distress syndrome hereafter [1,2]. The two had no epidemiological link and no known exposure to evidently sick animals. One of them was a pork butcher. The third case was a 35-year-old woman from Anhui province, adjacent to Shanghai, who also became ill with ILI with symptom onset on 9 March followed by severe respiratory disease and death.

When this H7N9 virus was been studied by certain researchers in China they said about the genetical constitution or genetic makeup of the virus and reported that the virus were not having a same genetic makeup or do not have the resemblance of genetic makeup with any of the virus reported so far and then this virus must be the one which have been growing and circulating over the region for some time.

Later it was reported that this same genetic makeup was found in different species of poultry and environmental samples from live bird markets in Shanghai.



Fig: Microscopic view of H7N9 virus strain.

Definition: H7N9 is bird flu strain of the species influenza virus A. The virus normally circulates amongst avian populations with some variants known to occasionally infect humans.

Brief History:

Avian influenza viruses (AIVs) pose an important and continuous threat to public health. Since the first human infection with H7N9 AIV was identified in March

2013¹, there have been five outbreak waves in China during 2013–2017. As of 28th June 2017, there have been 1568 confirmed cases of human H7N9 infection and 599 deaths. With the exception of the first wave (February 2013–September 2013), all H7N9 AIV outbreaks have occurred during the winter–spring seasons, beginning in October, with cases increasing in number in late December, and peaking in January of the following year.

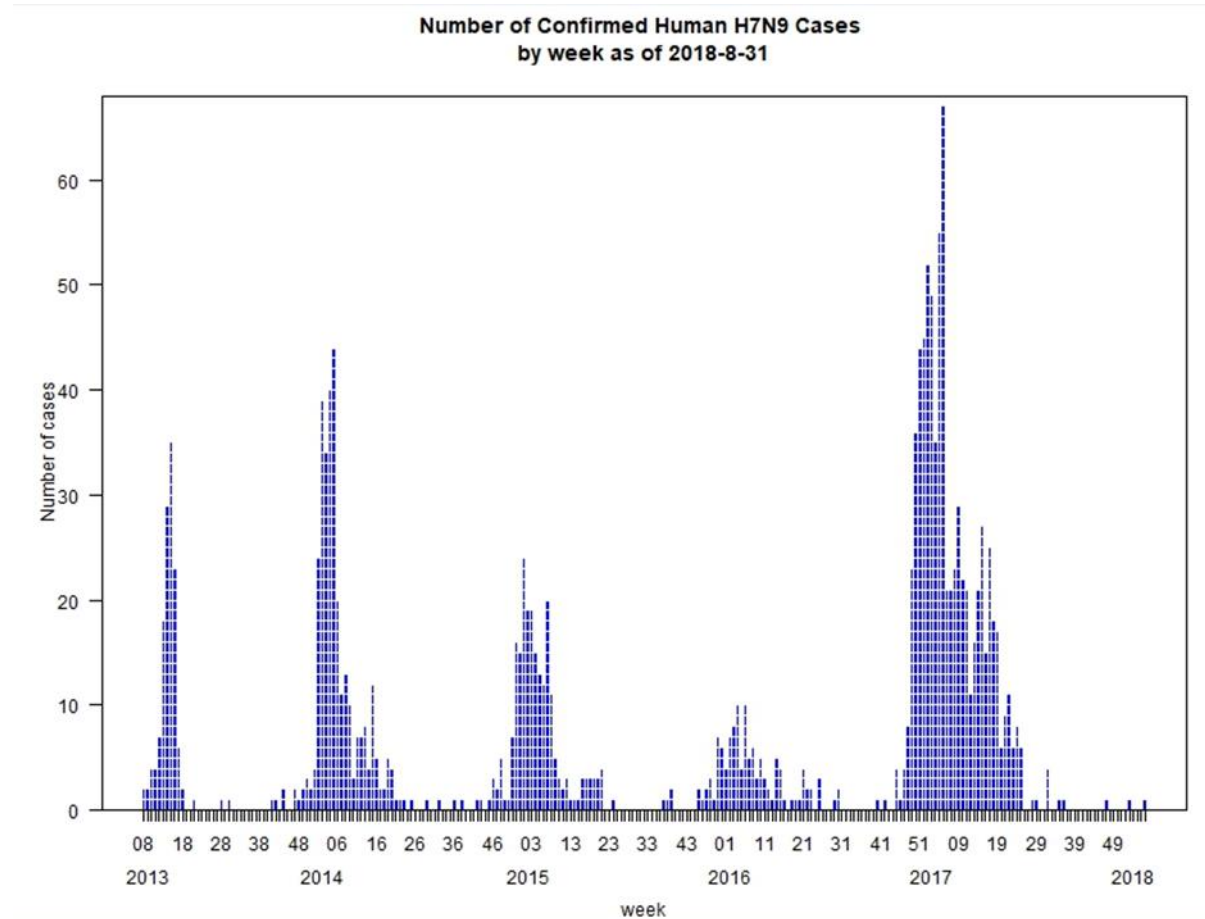


Fig: no of confirmed cases of H7N9 virus attack in China from 2013-2018

Epidemiology:

Most human infections with avian influenza viruses, including Asian H7N9 virus, occur after exposure to infected poultry or contaminated environments. Asian H7N9 viruses continue to circulate in poultry. Most reported patients with H7N9 virus infection have had severe respiratory illness (e.g., pneumonia). Rare instances of limited person-to-person

spread of this virus have been identified in China, but there is no evidence of sustained person-to-person spread. Some human infections with Asian H7N9 virus have been reported outside of mainland China, Hong Kong or Macao but all of these infections have occurred among people who had traveled to China before becoming ill.

A study showed that 68% of infected cases visited LPMs or were exposed to market poultry, even without direct (touching) or indirect (within 1 m) contact; it indicates that exposure to poultry in markets was associated with A (H7N9) virus infection, even without poultry contact. LPMs have been reported as a main source of H7N9 transmission by the way of human-poultry contact and avian-related environmental exposures; after LPM closure was enforced in several Chinese cities, the incidence of H7N9 human cases rapidly reduced. Even though human-to-human transmission has never been confirmed, there were some case reports of cluster in many cities of China.

Most affected H7N9 cases had a history of visiting LPMs or contacting with poultry 7–10 days before the onset of illnesses, indicating that the sources of infection were likely to be either contaminated environment or infected poultry.

People are also infected by these Asian lineage influenza virus due to severe exposure to nasal secretions of the infected persons when they sneeze the water droplets oozed out consists of virus probes which gets released to the air and environment and these then attacks the healthy people by making its way into the healthy peoples cell line of defense rendering them inactive and causing the disease by propagating and generation in the human body and getting transferred from one generation to another thus carrying the disease.

This virus is also spreading from eating unhygienic poultry foods or uncooked poultry foods meat or eggs from infected birds, chickens, turkeys, ducks and geese, and these birds or the other poultry animals get infected from the infected bird faeces that carries the virus along with them.



Fig: unhygienic meat vendors are the major source of H7N9 virus.

Etiological Factors:

H7N9 is a type of bird flu. It can pass from birds to humans. A disease that can pass from an animal to a human is called a zoonotic disease. H7N9 rarely passes from one person to another.

- H7N9 is a bird flu virus. It does not normally affect humans.
- However, the virus has mutated or changed, and it has become able to affect some humans.
- Humans do not have immunity to new viruses, and this is why a new virus is dangerous.
- Early symptoms include a fever, headache, and a cough. Pneumonia can then develop.

- Avoiding birds and poultry markets, especially when traveling, can reduce the risk of catching H7N9.



Fig: chest x-ray of the 27 yr old man infected with H7N9 virus.

Mode of transmission:

The H and N proteins in the virus change. The "H" protein, which stands for HA or hemagglutinin, and the "N" protein, which stands for NA or neuraminidase are the parts that change. The HA protein enables the virus to enter the host cells. The NA protein enables the virus to leave, or "shed." The shedding makes it possible for the virus to spread. Birds shed the virus in their droppings and in their mucus. If a person has contact with an infected bird, live or dead, and then they touch their eyes or mouth, for example, they may become infected. The Centers for Disease Control and Prevention note that

the virus may travel through the air, for example, if a bird flaps its wings. The bird may not appear to be ill, but a person can still catch the virus.

Sudden changes in the virus proteins take the human immune system by surprise. This is why a new variant causes more serious illness. The system has not met it before, so there is no immunity.

Symptoms:

The first sign of human infection with H7N9 is a high fever and a cough the virus causes serious respiratory symptoms, including severe pneumonia. This can be fatal. Sudden changes in the virus proteins take the human immune system by surprise. This is why a new variant causes more serious illness. The human's immune system has not met it before, so there is no immunity.

During the early stage, most people have shown the following symptoms:

- fever
- cough that produces sputum
- breathing problems and wheezing
- headache
- myalgia, or muscle pain

- general malaise

These symptoms are common to other kinds of flu. Symptoms in the later stages include:

- pneumonia in both lungs
- rapid progression to acute respiratory distress syndrome (ARDS)
- multi-organ dysfunction, including impaired liver or kidney function
- septic shock which is a blood infection
- rhabdomyolysis, or muscle breakdown
- encephalopathy, a brain disease

In the critical stages, patients often have thrombocytopenia, a reduced platelet count, and lymphopenia. A person with lymphopenia will have reduced numbers of lymphocytes, or white blood cells.



Fig: myalgia



Fig: Chest x-ray of 87 old year patient suffering from H7N9 virus

Results gathered after testing the three infected patients from CHINA who suffered first from the H7N9 virus:

Laboratory analysis:

Clinical samples obtained from all three patients were confirmed, by means of real-time RT-PCR, to be positive for H7N9 and negative for seasonal influenza viruses (H1, H3 or B), H5N1, SARS-CoV, and HCoV-Erasmus Medical Center (EMC). Complete sequences of the three H7N9 influenza viruses showed that they were 97.7 to 100% identical in all eight gene segments.

Phylogenetic analysis of all genes of the isolates showed that each gene was of avian origin.

The gene encoding hemagglutinin (HA) shared the highest identity with A/duck (H7N3, subtype ZJ12). The gene encoding neuraminidase (NA) protein was most closely related to A/wild bird (H7N9, subtype KO14); however, the HA gene from the H7N9 viruses in our three patients was highly divergent from that in the KO14 virus. All six internal genes shared the highest similarity with A/brambling-like viruses (H9N2). Phylogenetic results indicated that it was a triple reassortant H7N9 virus.

In all three viruses, the HA cleavage site possesses only a single amino acid R (arginine), indicating low pathogenic effects in poultry. A T160A mutation was identified at the 150-loop (H3 numbering) in the HA gene of all three viruses. Substitution Q226L at the 210-loop in the HA gene was found in both the A/Anhui/1/2013 and A/Shanghai/2/2013 viruses but not in the A/Shanghai/1/2013 virus. Five amino acids were deleted in the stalk region of

NA residue 69 to 73. The M2 protein contained the S31N substitution, indicating resistance to amantadine. Other mutations — 89V and E627K in PB2 and 42S in NS1 — were also identified. The amino acids in A/Shanghai/1/2013, which differed from those in A/Anhui/1/2013 and A/Shanghai/2/2013. To date, five additional H7N9 viruses have been isolated from five patients. Sequencing analysis indicates that all five viruses are highly similar to both A/Shanghai/2/2013 and A/Anhui/1/2013. Some variability is observed, such as Q226L in HA and R292K in NA.

On the basis of these data, diagnostic tests for the novel reassortant H7N9 viruses have been developed.

CLINICAL FEATURES AND OUTCOMES OF THE PATIENTS:

The clinical characteristics of the patient's are- Fever and cough were the most common symptoms. The white-cell count was normal or slightly decreased. Bilateral ground-glass opacities and consolidation were detected on chest radiography.

Several complications of the illness were observed. All the patients had ARDS. Patient 3 had septic shock and acute renal damage. Carbapenem-resistant *Acinetobacter baumannii* was cultured from lower respiratory tract specimens obtained from two of the patients after the initiation of mechanical ventilation. Combination antibiotic therapy, glucocorticoids, and intravenous immunoglobulin were administered in all three patients. Antiviral therapy was initiated 6 to 7 days after the onset of illness.


Patient 1 declined admission to the intensive care unit (ICU) and intubation. He died from refractory hypoxemia 13 days after the onset of illness. Patient 2 was admitted to the ICU and incubated 48 hours after admission owing to progressive dyspnea. He died from refractory hypoxemia after 4 days in the ICU. ARDS and septic shock developed in Patient 3 on day 6 after the onset of illness. She was

admitted to the ICU, and extracorporeal membrane oxygenation was initiated. She died on April 9.

Prevention and control:

Treatment and vaccines: Existing antiviral drugs used against the common seasonal flu virus are given to people infected with the H7N9 avian flu. This class of drugs is known as neuraminidase inhibitors. They are recommended for use as soon as possible in people suspected of infection with H7N9. World Health Organization (WHO) guidance states that drugs should be given even before the laboratory confirms a case of H7N9. Two neuraminidase inhibitor drugs are recommended in the treatment of infection with the H7N9 avian flu virus. They are Zanamivir (Relenza, made by GlaxoSmithKline) and Oseltamivir (Tamiflu, made by Roche). These drugs are not effective in all people infected with H7N9, and even when they are effective - particularly when administered at the earliest opportunity - they reduce the severity of the illness rather than cure it. New drugs are being developed against influenza in general and may prove to be effective against H7N9, too.

Prevention:

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- Avoid travelling during outbreaks.
 - Poultry meat and eggs should be cooked at an temperature of 165⁰ F.
 - Eggs should be cooked till they turn firm.
 - Avoid domesticated birds

- Personal hygiene.
- Vaccination against H7N9 virus should be taken.

Complications of infection:

People with H7N9 flu may develop life threatening complications:

1. Pneumonia
2. Pink eye (conjunctivitis).
3. Respiratory failure
4. Kidney dysfunction.
5. Heart problems.



Death statistics due to H7N9 virus attack:

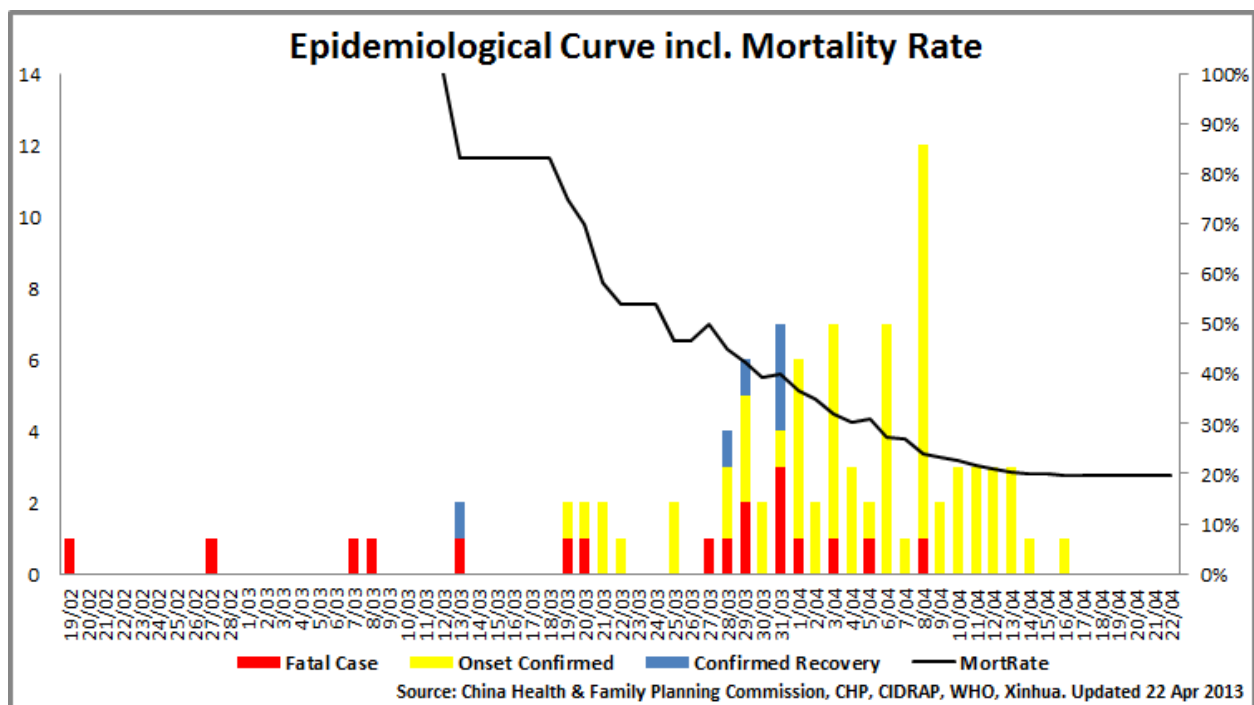


Fig: mortality rate curve due to H7N9 virus attack.

Conclusion:

H7N9 is a deadly disease killing peoples basically spread from avian species or by waterfowls. Simple preventive measures and precautions can save the lives of the people. People who are involved in poultry anywhere and those who are traveling to China should be especially careful around birds. The CDC advise people not to touch birds, whether alive or dead, and to avoid poultry markets and places where there may be bird feces. Meat and poultry should be fully cooked, and not pink, and eggs should be hard boiled. It is better to avoid food that contains the blood of any animal, and not to buy food from street vendors. Hand hygiene is important. This includes frequent hand washing with soap and water or use of a hand sanitizer with at least 60 percent alcohol. People should cough or sneeze into a tissue.

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