

# Avian Influenza (H5N1) and its Pandemic Potential

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## DESCRIPTION

Avian influenza or bird flu, a highly contagious, transboundary, viral respiratory disease of birds and sporadically infecting humans. The disease is caused by Avian Influenza type A Virus (AIV), belonging to the family Orthomyxoviridae. These are enveloped, single-stranded, negative sense RNA viruses with segmented genome (8 segments), coding for 12 major proteins. The virus sub-typing is done based on the two important viral surface glycoproteins such as Hemagglutinin (HA) and Neuraminidase (NA). The HA is involved in virus entry into the cell and NA in its release from the cell, thus playing an important role in influenza virus replication cycle. Till date, 16 HA and 9NA subtypes have been detected in birds, thus AIV can reemerge into 144 possible combinations [1]. Wild Aquatic birds act as natural reservoirs of influenza virus worldwide and the main source of infection to domestic poultry.

AIV are highly prone to mutations (RNA, segmented genome) and thus undergo rapid evolutionary changes through two key mechanisms. 1) Antigenic drift-gradual minor antigenic changes in viral surface glycoproteins HA and NA, leading to viral escape from host immune response, thus responsible for regular updating of flu vaccines. 2) Antigenic shift-abrupt major antigenic changes in viral surface glycoproteins HA and NA, resulting in the emergence of novel HA/NA virus subtypes through genetic re-assortment following mixed infection with two influenza virus subtypes, thus leading to influenza pandemic occurrence.

Based on the Avian Influenza Viruses (AIV) pathogenicity in chicken, they can be either as Low Pathogenic (LPAI) or Highly Pathogenic (HPAI) as defined by the World organization for animal health (OIE). H5N1 subtype is a highly pathogenic AIV causing almost 100% mortality in chickens and is around 60% fatal in humans. The zoonotic potential of avian influenza A (H5N1) virus was first reported in Hong Kong, 1997 [2-4]. A large number of zoonotic cases occurred in few Asian countries since 2003, mostly attributed to their peculiar food habits and close contact with infected birds. In India, the H5N1 outbreak in poultry occurred for the first time in 2006, but as of now, there is no report of H5N1 infection in human's in India. Recently, H5N1 was reported in dead crows in the periphery of Pong Lake Wetlands, Himachal Pradesh.

Thus, HPAI viruses' pose a huge threat to the poultry industry and are also a cause of concern for humans due to their reported zoonotic potential. The infected birds shed virus via nasal secretions, saliva and faeces. The high risk group includes poultry farmers, and those involved in poultry marketing business. The poultry workers can contract the infection either through direct contact, contaminated surfaces or through aerosol route. The close proximity of birds to humans further increases the risk of transmission to humans.

Pandemic threat to humans in case of bird flu are limited to 4HA types such as H5, H7, H9 and H10 (AIV subtypes H5NI, H7N2, H7N3, H7N7, H9N2 and H10N7). There are three important prerequisites for a virus leading to any pandemic occurrence. 1) The virus subtype must be novel to human population. 2) The virus must replicate efficiently in human cells and cause severe illness. 3) There must be sustained human to human virus transmission. The novel HA/NA virus subtypes emerging as a result of antigenic shift might trigger an influenza pandemic. The highly pathogenic avian influenza virus (H5N1) already satisfies the two prerequisites of pandemic occurrence, without efficient human to human transmission. Thus, we are at the brink of another pandemic.

Potential interventions are urgently required to prevent any future influenza pandemic. This can be done through controlling bird flu transmission in birds at the first step by following strict biosecurity measures at commercial poultry farms; Future permit for the construction of any new poultry farms should take into consideration the potential habitat sharing between wild aquatic birds and domestic poultry at water bodies, and also the zoonotic potential of avian influenza virus, thus avoiding poultry farms near water bodies and human habitations. Sero-surveillance at animal human interface should be conducted in real time manner. The rearing of ducks and chicken together should be avoided and vaccination of domestic ducks should be undertaken routinely. Also, we need to educate people involved in poultry rearing about the biosecurity measures, and creating awareness among the general public regarding the hygienic preparation and eating of well cooked chicken and eggs. Poultry workers and those involved in culling operations during bird flu outbreak need to be vaccinated against the common flu strains circulating in the human population to prevent any re-assortment of bird flu and human flu virus.

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## CONCLUSION

The control and eradication of avian influenza, requires a multidisciplinary approach (One Health) involving veterinarians, medicos, experts from epidemiology, public health, virology, ecology and wildlife at local, national and global levels.

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