



**Review Article**

**Avian and Human Influenza Pandemic, How Prepared is the Developing World?**

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**ABSTRACT**

The history of avian and human influenza pandemics showed a high case fatality and devastating socioeconomic impact on the developing world. The global epidemiology of the human influenza of 1918, 1957 and 1968 pandemics had few similarities. One of which was mass human migration, whether it being troop deployment or trade routes. How much the perennial flight patterns of wild bird had on its spread is another question for consideration? The avian influenza virus does not readily cross the species barrier, though there is a potential for genetic re-assortment and cross infection. The main finding of this review suggest a lack of historic epidemiological data from the developing world on previous influenza pandemics, a poorly developed surveillance system and lack of health service delivery capacity to effectively combat an outbreak of influenza, should it occur. The developing world already heavily burdened with endemic diseases such as malaria, HIV, Tuberculosis and other respiratory tract infections will find it difficult to cope with an influenza pandemic. A preparedness plan for developing countries should include health systems strengthening especially that providing expertise and improved surveillance tools.

**Keywords: Influenza, Pandemic, Preparedness, Health systems**

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**INTRODUCTION**

Most developing countries, in Sub-Saharan Africa, Asia and South America are heavily burdened with infectious diseases like Human Immunodeficiency Virus, Tuberculosis and Malaria, childhood illnesses, and high rates of maternal and childhood mortality. This is compounded by political instability, poor health infrastructure and insufficient budgetary allocation to the health sector. To militate against these challenges, the United Nations World Health Assembly formulated the Millennium Development Goals (MDG) with targets to reduce the disparity of socioeconomic and health indicator between develop and developing world.

Avian influenza 'commonly known as bird flu' is influenza like illness found principally in wild birds and domestic poultry. However, it has a potential of cross infectivity to humans and other animal species but this is a rare occurrence. The causative agent of avian influenza and other influenza is a single stranded RNA virus that belongs to the family Orthomyxoviridae. There are about 15 species known, differentiated by surface glycoprotein haemagglutinin (H) and neuramidase (N). There is slight variability in genome of influenza virus with frequent genetic drifts and occasional shifts. The H5 and H7 strains have shown to be the most infective.

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In the past, avian and human influenza outbreaks have had severe health and economic consequences, mainly in South-east Asia, North America and Europe. Information on the epidemiology of the disease in Sub-Saharan Africa and South America has been limited. The present avian influenza outbreak has a potential to impact health and economy worldwide with dire consequences. The regional offices of World Health Organization (WHO) and Food and Agricultural Organization (FAO) have taken a lead role in coordinating preparedness and surveillance programme against avian and human H5N1 influenza epidemic.

#### **METHODOLOGY**

A computerized literature search was conducted on Medline database with search terms avian, influenza, pandemic, history. There were 39 hits but only four papers were found to be pertinent to influenza pandemics and the developing world. In addition, the websites of the World Health Organization (WHO) (Head Office and Africa Regional Office), European Centre for Disease Prevention and Control and Health Protection Agency (England) were searched for related papers and preparedness plans.

#### **Historic perspective and global epidemiology**

##### **1918 Influenza pandemic:**

If we compare this H5N1 influenza threat with the 1918 influenza pandemic, its geographic origin and source though unknown, "some medical historians suggest China or a Midwestern US military camp" (Cox and Subarao, 2000). Subsequent outbreaks of influenza with unprecedented virulence occurred in North America, Europe and Africa in August 1918 (Crosby, 1989). The spread of the influenza pandemic appeared to follow closely that of military troop movements and re-deployment or mass migration. This pandemic is considered one of the deadliest disease events in human history with an estimate of 50% of the world's population

infected; approximately 25% suffered a clinical infection (illness with symptoms) and the total excess mortality was between 40 to 50 million with the attack rate and mortality rates highest among young adults aged 20-40 years (HPA, 2007). The WHO and other surveillance systems for disease at that time were virtually non-existence.

##### **1957 Influenza pandemic:**

By the 1950s WHO and other disease control agency were better developed. The 1957 pandemic was recognized relative early with origin in China in February 1957. Its source is believed to be of avian origin, with re-assortment of genetic material resulting in the pathogenic strain H2N2 (Reid and Tauberberger, 2003). Within 6 months it spread to other part the world, India, Indonesia and Australia by May; to Pakistan, Europe, North America and the Middle East by June; to South Africa, South America, New Zealand and the pacific Islands by July; and to Central, West and East Africa, Eastern Europe and the Caribbean by August (HPA, 2007). The spread closely followed shipping and trade routes at the time. The disease affected mainly the young able bodied but it was not as deadly as the 1918 influenza. It occur in two waves in 1957 and late 1958 with a death toll estimated at over 1 million.

##### **1968 Influenza pandemic:**

This influenza pandemic also started in China and spread rapidly to whole of Southeast Asia. Its spread appeared to follow movement of US marines from Vietnam to the Americas and then Europe and South Africa. The WHO surveillance system had warned of an emerging pandemic and vaccine was produced within few months. The pathogenic strain was identified as H3N2, its origin also linked to avian species (Reid and Tauberberger, 2003). Closely following shipping and trade routes, the pandemic span to 1970 with an estimated mortality of 1-3 million (Cox and Subarao, 2000; HPA, 2007

Avian influenza is not a new disease entity with sporadic outbreaks known to occur in domestic birds. The natural reservoir is wild bird, which are resistant to less virulent strains. However, variation in viral genome has resulted in the virulence H5N1 strain that has caused death amongst wild and domestic birds, initially in South-east Asia.

Recently, cases of H5N1 avian influenza have been reported in different parts of the world, Asia, Eastern and Central Europe and lately in Nigeria, Niger, Cote d'Ivoire, Egypt and Sudan (WHO, 2007). Is the dispersal of this present avian influenza due solely to migratory patterns of wild birds or does economic activity play a role? The influence of climate change, the proximity of different parts of the world by increased trade and more efficient modes of travel may have a role to play with the spread of an H5N1 Influenza pandemic.

Another question of concern is the potential of cross infection from birds to humans and the transmission from human to human. The H5N1 virus does not spread easily from birds to humans. It has been postulated that if a person is infected with human influenza and contacts bird influenza virus at the same time, there is a danger of re-assortment of genetic material to produce a new influenza strain capable of human-to-human spread. A WHO (2005a) report postulates that a pandemic can start when three conditions occur:

- A new influenza virus subtype emerges
- It infects humans causing serious illness
- It spreads easily and sustainably amongst humans

#### **How a human influenza pandemic may present**

Whilst the epidemiology of influenza in industrialized countries is well understood, information on influenza in developing countries is scanty (Heymann, 2004). The clinical presentation will generally be the same, whether in the developed or developing world. The incubation period of human influenza is 1-3 days,

with period of infectivity 3-7 days from the onset of clinical symptoms. The duration of illness is usually 7 days but this may be complicated by secondary bacterial pneumonia (Heymann, 2004). The clinical sign and symptom of human influenza include:

- Fever
- Sore throat
- Cough
- Muscle aches
- Headaches
- Dyspnoea
- Chest pains

These signs and symptoms however mimic a number of common tropical diseases such as acute bronchitis, pneumonia, tuberculosis and malaria to name a few. In addition, epidemiological surveillance reports have shown recurrent episodes of seasonal influenza with cases reporting the above symptoms (HPA, 2007). On the contrary, human influenza (due to H5N1 strain) has been shown to have a high case fatality rate of slightly over 50%. The latest figures reported by the World Health Organization show a cumulative total of 394 cases of H5N1 human influenza with a mortality of 248 cases between 2003 to January 2009 (WHO, 2009).

#### **The preparedness for avian or human influenza pandemic**

Most developing countries especially in Sub-Saharan Africa, South East Asia and South America are heavily burdened with endemic infectious diseases such as malaria, HIV, tuberculosis, and other respiratory tract infections. In addition, their economies are recovering from civil conflict and uncontrolled corruption, and still have to contend with increase poverty, malnutrition, poor housing and infrastructure, and poorly functioning health facilities.

The emergence of avian influenza, and even worse a strain of H5N1 influenza virus with capacity for transmission from human to human will be catastrophic. As public health and other health professionals, we need to periodically evaluate the preparedness for a pandemic in developing countries more critically and find workable solutions to challenges this presents. These may be examined from two perspectives; health sector and socioeconomic situation.

The budgetary allocation to support the health sector in most developing countries is grossly inadequate and relies heavily on donor organizations such as World Bank, WHO, the

United Nations Children's Fund (UNICEF), European Union (EU), the Department for

In addition, health institutions are in a deplorable state and in need of refurbishment and modernization. Most health institutions at best are comparable to those of the 1950s or 1960s in developed countries. The infrastructure in some rural areas may be comparable to the 1920s Europe and America.

The WHO guidelines for global preparedness include:

- Surveillance
- Information dissemination
- Vaccine and Antiviral stock piling
- Staff training
- Infection control measures (WHO, 2005b)

These guidelines are excellent but may not be applicable in many developing countries because of inadequate resources, poor infrastructure and poorly functioning health system. The proliferation of mobile phone, portable computer systems and solar power technology may enhance surveillance, information dissemination and vaccine delivery systems in these regions. A workable approach is overall strengthening of health systems in developing countries with the aim of gradually overcoming infrastructural and communication barriers. Ong *et al.* (2008) proposed that avian influenza pandemic preparedness must be incorporate into a general national emergency preparedness framework. Strengthening health emergency services, communication and information dissemination support this. Most developing countries have taken positive strides in reforming and restructuring their health service in terms of emergency preparedness but many of the challenges remain.

As stated in European Commission Disease Control and Prevention avian influenza advisory forum, "the confirmation that H5N1 avian influenza in farmed poultry in Nigeria has important public health implications for both Africa and Europe (ECDC News, 2006). If H5N1 becomes entrenched in African bird populations, it will be difficult to remove. Many people live closely with poultry in Africa as they do in East and South East Asia and so these human populations will be at high risk of infection. A number of EU countries have substantial African

International Development (DFID) and Global Fund to sustain most of their programm

populations that move to and fro between Europe and Africa" (ECDC News, 2006). The surge capacity to contend with such an outbreak is lacking but needs to be developed to prevent a high case fatality and contain the outbreak if or when it does occur. Most developing countries lack the resources to procure and stockpile the antiviral drugs (Oseltamivir or Zanamivir), uncertain about when it will be required and how effective it will be.

In terms of strengthening health surveillance systems and prevention of avian and human influenza in the developing world, the regional offices of WHO and FAO have taken a lead role. These have included introduction of the Integrated Disease Surveillance Reporting system (Perry *et al.*, 2007), and a strategic action plan for responding to an avian influenza pandemic threat with early warning systems, containment and delay of spread, and limiting damage or disruption to normal activities (WHO, 2005c). In Africa, the WHO region office (AFRO) has developed guidelines to strengthen surveillance and plan of action in event of an influenza outbreak (WHO, 2005a).

The socioeconomic consequences in developing countries will be enormous. Economic loses in previous pandemics of influenza or other infectious diseases have run into the millions of US dollars. Thus, early planning beyond health or medical intervention, focusing on critical infrastructure, private sector activities, movement of goods and services is essential (Ong *et al.*, 2008). The population most at risk is the rural poor who are involved in subsistent farming with poultry roaming freely in backyards. The culling of poultry and other farm birds seen in Europe will destroy the livelihood of the local poultry industry, as funds for compensation by governments may be a problem. Further, the determination of government enforcement agencies to effectively control trade and transportation restrictions is lacking as seen recently in Nigeria and Niger on news media reports. These reported peasants

taking culled chickens for food in deprived communities though no human cases have been reported from feeding on poultry.

## CONCLUSION

To conclude, influenza infection unlike HIV, tuberculosis or malaria, is an acute illness with a

infections with symptoms stated above not responding to conservative management should alert health authorities. The WHO global alertness and preparedness is a step in the right direction but developing countries will need more expertise, close supervision and funding to strengthen their active surveillance system to militate against an influenza pandemic. Early case detection and prompt practical preventive measure may be the only tools available to effectively control the outbreak in the developing world should it occur.

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