# The resurgence of Avian influenza and human infection: A brief outlook

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Dear Editor,

Avian influenza is a highly contagious disease that primarily affects birds. However, the recent increase in the number of human cases has raised concerns for public health authorities worldwide. The widespread dissemination of the disease among wild birds and poultry can result in disastrous economic and environmental losses, and have the potential to cause a pandemic [1].

Avian influenza is caused by the avian influenza virus (AIV), which is a type A influenza virus specifically adapted to affect birds. Although human transmissions are not very common, they have been reported and are of rising public health concern. The virus has numerous subvariants due to the variation in the viral surface proteins, hemagglutinin (H) and neuraminidase (N), which aid the viral particle to enter the host. The greatest risk is from a sub-variant of avian influenza called highly pathogenic avian influenza (HPAI). HPAI is caused by the Influenza Type A virus subtype H5N1, which is responsible for causing more severe disease in the birds. Apart from H5N1, multiple other subtypes exist; however, five subtypes are more commonly known to cause disease in humans: H5N1, H7N3, H7N7, H7N9, and H9N2 [2]. To understand recent outbreaks of the disease in the bird population and the reasons behind human cases, we need to review the history of AIV outbreaks in the past. The first instance of the widespread disease in poultry was reported in 1878 in Italy. However, it was not until 1955 that the pathogen responsible for the disease was identified as a type A influenza virus. The infamous flu pandemic of 1918–1919, more popularly remembered as the "Spanish flu," that killed an estimated 50–100 million people worldwide, was later found to be caused by an avian-like H1N1 virus. By the mid-1900s, the HPAI strain and its related outbreaks had been reported almost throughout the major world regions [3]. The first-ever cases of zoonotic transmission from animal to human were reported in 1997 in Hong Kong, which resulted in 18 confirmed cases and six deaths. These were the first confirmed H5N1 human infections with fatalities.

In the last few decades, due to improved biosecurity measures and increased wild bird and poultry surveillance, the number of major outbreaks has been reduced. However, despite such measures, intermittent reports of smaller outbreaks are still being reported. Consistent rapid changes in the genetic makeup of viruses mean that more new strains have been introduced which can result in more severe diseases [4]. Multiple sporadic outbreaks have been reported in the last few years, most of them being identified in the United States, Mainland China, East Asia, and some smaller outbreaks in Europe. No major outbreak among humans has been reported so far, but the number of confirmed cases and deaths from 2020 to 2023 is presented in a tabulated form in Table 1.

Most human infections are transmitted from birds mainly from poultry contacts such as farmers or poultry workers. Clinical manifestations in birds can include respiratory distress, decreased egg production, diarrhea, and death. In some instances, like in cases of the Low Pathogenic variant of Avian Influenza (LPAI), infected birds may show no visible symptoms, or very mild symptoms making early detection and control measures challenging. However, it is crucial to be aware of the signs and symptoms of AIV in birds to prevent outbreaks and limit the spread of the virus to humans. In humans, AIV infection can cause symptoms ranging from mild to severe, including fever, cough, sore throat, muscle aches, and fatigue. Severe cases of AIV infection can also lead to pneumonia and other respiratory illnesses, which can lead to multiple organ failure



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**TABLE 1. Number of human cases of Avian Influenza Virus (AIV) in the year 2020–2023.**

| Year | Number of cases (strain/subtype) | Country or region |
|---|---|---|
| 2020 | 5 (HPAI/H5N6) | Mainland China |
| | 6 (LPAI/H9N2) | Mainland China |
| | 1 (HPAI/H5N6) | Russia |
| | 1 (LPAI/H9N2) | Hongkong (China) |
| | 1 (LPAI/H9N2) | Senegal |
| 2021 | 1 (HPAI/H5N6) | Laos |
| | 1 (LPAI/H10N3) | China |
| | 36 cases with 18 deaths (HPAI/H5N6) | China |
| | 24 cases with 1 death ((LPAI/H9N2) | China |
| 2022 | 1 (HPAI/H5N1) | England |
| | 1 (HPAI/H5N1) | United States |
| | 1 (LPAI/H3N8) | China |
| | 11 cases with 2 deaths (HPAI/H5N6) | China |
| | 12 (LPAI/H9N2) | China |
| | 1 (LPAI/H9N2) | Cambodia |
| | 1 (LPAI/H10N3) | China |
| | 2 (HPAI/H5N1) | Spain |
| | 1 HPAI A (H5) | Vietnam |
| | 1 case and 1 death (HPAI/H5N1) | China |
| 2023 | 1 HPAI A (H5) | Ecuador |
| | 2 cases and 1 death (HPAI/H5N1) | Cambodia |

Source: United States Center for Disease Control and Prevention

and death if not treated promptly. Not all strains of AIV follow this pattern, as some strains result in initial symptoms of conjunctivitis and encephalopathy (as in the case of the H7N9 strain [5].

Apart from the risk of increasing human infections due to recent outbreaks, avian flu also has economic implications as the disease can lead to the culling of millions of birds, causing significant economic losses for the poultry industry. For example, due to the ongoing resurgence of bird flu in the UK, more than 5.5 million birds were culled from October 2021 to November 2022. The 2022 avian flu outbreak in the United States has resulted in about 40 million animal losses and economic costs ranging from $2.5 to $3 billion. The social implications of avian influenza outbreaks are also significant. The disease can lead to fear and panic among the public, leading to the stigmatization of affected communities and a breakdown in social cohesion. Furthermore, the disease can also have an impact on food security, particularly in developing countries where poultry is a major source of protein.

In conclusion, the recent outbreaks of avian influenza have significant implications for human health, the economy, and society as a whole. The risk of human infection, economic losses, disruptions to trade, and social impacts are all serious concerns that require effective prevention and control measures. As the virus is circulating among birds mainly, the risk of human sporadic cases is possible. Additionally, sustained human-to-human transmission can happen and lead to an outbreak or even a pandemic [1]. Thus, the at-risk human groups (i.e., poultry keepers, healthcare workers, etc.) should follow preventive measures seriously, including but not limited to personal protective equipment and other hygiene and sanitation measures [1]. The international community must work together to prevent and control the spread of the disease, including the development of effective vaccines and the implementation of biosecurity measures. While the recent outbreaks have highlighted the potential risks of avian influenza, they also present an opportunity to strengthen global preparedness and response to emerging infectious diseases including surveillance and to implementing appropriate measures to stop the spread of avian influenza virus from birds to the poultry population and to humans.

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## Authorship contribution

RAF: the conception and design of the study. RAF and SHK: acquired information and drafted the articles. RAF, AAR, and JAT: interpretation of data and revising it critically for important intellectual content. All the authors gave final approval of the version to be submitted.

## Declaration of competing interest

All authors declare no conflict of interest, except JAA is an Associate Editor in NMNI and has no conflict of interest as well.

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## References

[1] PAHO/WHO | Pan American Health Organization. PAHO issues alert on outbreaks of avian influenza in birds in ten countries of the Americas

n.d. https://www.paho.org/en/news/17-1-2023-paho-issues-alert-outbreaks-avian-influenza-birds-ten-countries-americas. [Accessed 4 February 2023].
[2] Li Y-T, Linster M, Mendenhall IH, Su YCF, Smith GJD. Avian influenza viruses in humans: lessons from past outbreaks. Br Med Bull 2019;132:81–95. https://doi.org/10.1093/bmb/ldz036.
[3] CDC. Highlights in the history of Avian influenza (bird flu) timeline – 1880 - 1959 n.d. https://www.cdc.gov/flu/avianflu/timeline/avian-timeline-1880-1959.htm. [Accessed 28 February 2023].
[4] Watanabe Y, Ibrahim MS, Suzuki Y, Ikuta K. The changing nature of avian influenza A virus (H5N1). Trends Microbiol 2012;20:11–20. https://doi.org/10.1016/j.tim.2011.10.003.
[5] Kelly TR, Hawkins MG, Sandrock CE, Boyce WM. A review of highly pathogenic avian influenza in birds, with an emphasis on Asian H5N1 and recommendations for prevention and control. J Avian Med Surg 2008;22:1–16. https://doi.org/10.1647/2006-036R.1.