H5N8 HPAI IN UGANDA
Further spread in Uganda and neighbouring countries (February 2017)

SUMMARY

- The experts participating in this rapid risk assessment considered that the spread of H5N8 HPAI from Uganda to Kenya is likely, with a mean risk score of 3.9 on a scale of 0 to 6, compared with spread to the Republic of Tanzania – mean risk score 3.4 – and Rwanda – mean risk score 3.2. The uncertainty of the estimations is high.
- The likelihood of H5N8 HPAI spreading inside Uganda is moderate, with a mean risk score of 3.9 and a medium level of uncertainty.
- The consequences in the next six months of the spread to poultry are more likely to be evident in backyard rearing – mean risk score 6.5 – than in commercial operations – mean risk score 6.2.
- With regard to preventing the spread of H5N8 HPAI, while the experts indicated that increased biosecurity and communication campaigns for farmers would be the optimum controls, they considered that a ban on movements of domestic birds would be the least feasible.
- In terms of the effectiveness of the mitigation options, the experts ranked increased biosecurity as the most effective control, followed by communication and awareness campaigns for farmers and a ban on movements of domestic birds. The experts did not agree on the feasibility or effectiveness of extensive culling in the current situation.

ASSESSMENT

Epidemiological situation

On 2 January 2017, major mortality among white-winged terns (Chlidonias leucopterus) was reported in Uganda. The mortalities had started in mid-December 2016 along the shores of Lake Victoria in Lutembe Bay in Wakiso district and in Kachanga village in Masaka district: there were 1,200 deaths in an estimated tern population of 2,000 – a mortality rate of 60 percent. On 13 January the Uganda Virus Research Institute confirmed the presence of H5 Highly Pathogenic Avian Influenza (HPAI). A spillover of H5 HPAI virus from wild to domestic birds was detected in Kachanka village, where 20 birds showed clinical signs and seven died in a population of 30,000. Unconfirmed deaths among wild birds were also reported in Kalangala district. On 25 January 2017 the virus was characterized as H5N8 HPAI.

The region under consideration has a high density of backyard chickens (Figure 1) and lies on a major migration pathway (Figure 2).

No human cases of infection with H5N8 HPAI virus have been detected to date.1 More information on the global and regional

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1 The World Health Organization (WHO) considers human infections with A(H5) viruses to be rare, generally occurring in individuals exposed to sick or dead infected birds or their environments, but does not exclude possible human infections with the H5N8 virus; the likelihood is low, however, and is based on the limited information obtained to date. WHO assessment of risk associated with influenza A (H5N8) virus, 17 November 2016.
situation of H5N8 HPAI, avian influenza (AI) drivers and the zoonotic potential of H5N8 HPAI can be found in Annex 1.

The discovery of HPAI in Uganda in 2017 raises concerns because there are various factors that could contribute to further spread. These include: i) a domestic poultry population estimated at 44.5 million in 2014; ii) informal trade of domestic poultry and poultry products in the region; iii) the presence of the disease in a seasonal shelter of migratory birds; iv) the existence of numerous important water bird areas on migration pathways.
and unregulated live bird markets; v) a large number of backyard poultry producers; and vi) commercial marketing of birds through the same live-bird marketing system.

RISK ASSESSMENT
Four general risk questions were submitted to FAO and external AI experts:

1. What is the likelihood of H5N8 HPAI spreading from Uganda to other countries in the region?
2. What is the likelihood of further spread of the H5N8 HPAI virus within Uganda?
3. What will be the consequences over the next six months of the spread of H5N8 HPAI in a) the commercial poultry production system, and b) the backyard poultry population?
4. What control measures could be put in place to reduce the risk of H5N8 HPAI spread in the region? Rank from most to least feasible a) preventive and b) control options for reducing the spread of H5N8 HPAI in the region.

A standard grid was used to gather responses from the experts. For details see Appendix 2.

Experts consulted
The questionnaire was submitted to three FAO and 18 external experts in the last week of January 2017, with responses to be given within 48 hours. Responses were received from two FAO and seven external experts:

FAO
- Guillaume Belot, Headquarters
- Fredrick Kivaria, Uganda

External
- Mark Stevenson, University of Melbourne
- Nick Taylor, University of Reading School of Agriculture, Policy and Development
- Isabella Monne, Istituto Zooprofilattico Sperimentale delle Venezie, an Italian research organization for animal health and food safety
- William B. Karesh, Ecohealth Alliance
- Ted Leighton, University of Saskatchewan
- Dirk Pfeiffer, City University of Hong Kong
- David Swayne, United States Department of Agriculture

Results
The results of the consultation are given below. The experts’ responses are presented for each question.

Question 1: What is the likelihood of H5N8 HPAI spread from Uganda to other countries in the region?

The mean values of estimates were in the category “as likely as not” – 33 percent to 66 percent chance, score 3 – for the likelihood of spread to all three countries under consideration.

The likelihood of the disease spreading into other countries in the region is similar for each country (ANOVA test: F = 0.76191; P>0.05), but with different values of variability (see Table 1 and Figure 3). The standard deviation values, which express the variability of experts’ estimations, are showing a greater consensus in relation to the probability of spreading to Kenya.

Uncertainty was expressed by the experts, of whom four indicated a high level of uncertainty in all cases (see Figure 4).
Question 2: What is the likelihood of further spread of the virus within Uganda?

The mean value of experts’ estimates was 3.9; no estimate was less than 3. One expert considered the probability of further spread in Uganda as “very likely”, and another as “extremely likely” (see Figure 5).

With regard to uncertainty in relation to this question, most of the experts indicated a “medium” level (see Figure 6).

Question 3: What will be the consequences over the next six months of the spread of H5N8 HPAI in Uganda’s commercial and backyard poultry production systems?

In response to this question the experts expressed a mean risk value of 6.2/10 (see Annex 2 for methods), indicating a medium risk of spread in the commercial poultry sector (see Figure 7).

With regard to the consequences of the spread of H5N8 HPAI in Uganda’s backyard poultry population within the next 6 months, the mean value of risk is 6.5/10 (see Figure 8).

Question 4: What control measures could be put in place to reduce the risk of H5N8 HPAI spread in the region?

The experts were asked two sub-questions to rate the following control measures from most to least feasible and most to least effective:

- Controls in live bird markets;
- Increased biosecurity in commercial flocks;
- Communication campaigns for farmers and other professionals with a view to reducing the risk of animal-sourced infections;
- Culling sick and infected animals;
- A ban on movements of domestic birds;
- Communication campaigns for the public on measures for reducing exposure.

The most feasible mitigations included increased biosecurity and communication campaigns for farmers. A ban on movements of domestic birds was considered the least feasible control measure (see Figure 9).
In terms of effectiveness, the experts ranked increased biosecurity as the most effective control, followed by communication campaigns for farmers and a ban on movements of domestic birds. The experts did not agree on the feasibility and effectiveness of culling in the current circumstances (see Figure 9).

DISCUSSION
This risk assessment shows that the likelihood of H5N8 HPAI spreading from Uganda to Kenya is “likely”, with a mean risk score of 3.9/6; the estimate for spread into the Republic of Tanzania was 3.4/6, and into Rwanda 3.2/6. The experts were more confident that the disease would spread to Kenya than to the other countries, probably because poultry farming operations are contiguous at the Uganda/Kenya border.

The likelihood of H5N8 HPAI spreading within Uganda is likely, with a mean risk score of 3.9/6 and medium uncertainty.

The experts considered that the consequences of spread over the next six months in Uganda’s poultry sector would be more evident in backyard poultry production than in commercial operations. If the commercial poultry sector were to be affected, there would be widespread disruption affecting poultry farmers and consumers and elements in the value chain such as increased costs of transport and processing and higher market prices.

Experts considered that the most effective approaches for preventing the spread of the disease include increased biosecurity, communication campaigns targeting farmers and a ban on movements of domestic birds. In view of Uganda’s particular agro-ecological characteristics and taking into consideration the location of the outbreak, the experts considered that the most feasible options for stopping the spread of H5N8 HPAI were increasing the level of biosecurity on farms and in the value chain, and communication campaigns targeting poultry farmers, particularly the backyard sector.

The experts did not agree on the feasibility and effectiveness of culling because no compensation scheme is in place. Banning the movements of domestic birds was considered the least feasible control option because in the current situation such a ban could in fact spread the disease further through informal trade and movements of potentially contaminated poultry and products.

The experts attributed a high level of uncertainty to their estimates. Several sources of uncertainty could affect the conclusions of this risk assessment.

1. What is the likelihood of H5N8 HPAI spreading from Uganda to other countries?
   i. The true extent of the infection in domestic poultry, including ducks and geese, and among wild birds is unknown. No surveillance results are available.
   ii. The effectiveness of the ban on cross-border trade of live birds with neighbouring countries is unknown. It can be assumed that no control measures can be fully effective in the current circumstances and that a degree of cross-border permeability must hence be assumed. The extent of the threat posed by informal cross-border trade is unknown.
   iii. There is some information on the species and densities of wild birds in wetlands near Lake Victoria, but few data are available for other areas of the lake or the degree of contact between wild bird populations across national borders. In view of the impossibility of controlling or preventing infection among wild birds, this information would make it possible to assess the probability of international spread around Lake Victoria through the transmission via wild bird populations and potential contact with backyard and commercial poultry.
   iv. Given the very dry weather in the region, the movement of wild birds is likely to be influenced by the availability of food and water: they will be likely to congregate in particular places, thereby increasing contacts and likelihood of exposure and hence increasing the rate of transmission.
   v. Uganda continues to import AI-susceptible poultry and poultry products from countries reporting cases of H5N8 HPAI; the Netherlands is an example. Commercial poultry is generally safe, consequently a possible incursion into Uganda through controlled trade is unlikely.

2. What is the likelihood of further spread of the virus in Uganda?
   i. A major factor in the possible spread of infection in the Ugandan poultry sector is the system of poultry value chains and live-bird markets. The literature suggests a dense network of interconnected live-bird markets characterized by poor hygiene and biosecurity. Transporters, middlemen and chicken vendors also participate in the trade.
ii. The effectiveness of current AI control measures and the level of compliance with them are unknown, but it can be assumed that they are not perfect and that live-bird markets and poultry transporters are hence potential sites contributing to the spread of infection.

iii. Official data on the Ugandan poultry sector indicate that only 20 percent of the farms are commercial or intensive holdings. No information is available on the biosecurity of these farms, their connections with live-bird markets or compliance with regulations. These factors may influence the susceptibility of the commercial sector to infection.

3. What would be the consequences of the spread of H5N8 HPAI in Uganda’s commercial and backyard poultry production system over the next 6 months?

i. No information is currently available on the virulence of this H5N8 HPAI strain, which is isolated in Uganda. The mortality data for poultry is partial and related to only a few reported outbreaks.

ii. With regard to backyard farms, the types of poultry kept – for example ducks and geese, chickens or laying hens – are important factors in estimating the possible effects of the disease.

iii. In the commercial poultry sector, types of birds handled and especially high-value parent or grandparent birds may significantly influence the scale of the effects of the disease.

Annex 1
H5N8 HIGHLY PATHOGENIC AVIAN INFLUENZA

Background
The global situation
Several highly pathogenic avian influenza (HPAI) serotypes and clades are in circulation. A major wave of the latest HPAI incursions is currently associated with the presence of H5N8 in migrations of wild birds: this relates to the detection of H5N8 HPAI in June 2016 in the south of the Russian Federation. Since then it has been spreading, mainly in Europe, following bird migratory routes, and has been detected in 30 countries in Africa, Europe and Asia. No human cases of avian influenza H5N8 infection have so far been reported in relation to this virus or other viruses of its subtype. Other circulating strains include H5N6 HPAI, detected in Japan and the Republic of Korea, and several H5N1 HPAI clades found in Bangladesh, Egypt, India, Indonesia, Iraq, Nigeria and Viet Nam, and in some West African countries.

Co-circulation and multiple infections of AI viruses in poultry or wild birds provide opportunities for recombination of viruses of different origins. Figure 10 shows the global distribution of all HPAI events in domestic birds, wild birds and humans from 1 June 2016 to 31 January 2017; Figure 11 shows H5N8 HPAI events during the same period; Figure 12 shows weekly outbreaks of H5N8 in wild birds and domestic birds in Europe since June 2016.

FIGURE 12. Outbreaks of H5N8 in domestic, wild and captive birds: 1 June 2016 – 31 January 2017
The situation in Uganda
On 2 January 2017, major mortality among white-winged terns (Chlidonias leucopterus) was reported in Uganda. The mortalities had started in mid-December 2016 along the shores of Lake Victoria in Lutembe Bay in Wakiso district and in Kachanga village in Masaka district: there were 1,200 deaths in an estimated population of 2,000 – a mortality rate of 60 percent. On 13 January the Uganda Virus Research Institute confirmed the presence of H5 Highly Pathogenic Avian Influenza (HPAI). A spillover of H5 HPAI virus from wild to domestic birds was detected in Kachanga village, where 20 birds showed clinical signs and seven died in a population of 30,000. Unconfirmed deaths among wild birds were also reported in Kalandala district.

The virus was characterized as H5N8 HPAI on January 25, and reported to the OIE on January 27 (OIE/WAHIS, 2017). The disease is still restricted to the shores of Lake Victoria in Mazinga, Bubeke, Kyamuswa, Bufumira, Bujumba and Mugoye sub-counties in Kalandala district where 220 wild birds, 2,900 domestic ducks and 1,200 chickens died. The sub-county of Kyesiga in Masaka district estimated a loss of 1,250 domestic birds and 150 wild birds at five sites. On 18 January 2017 media articles reported that the governments of Kenya and Rwanda had banned imports of poultry and poultry products from Uganda (the East African, 2017).

The region under consideration has a high density of domestic chickens and ducks.

The 2017 finding is not the first detection of H5 in Uganda. In 2010 a study detected H5 subtype at a prevalence of 0.7 percent-2.1 percent – of fresh faecal swabs taken from roosting sites of wild waterfowl (Kirunda et al., 2014).

Hazard identification: the presence of H5N8 in Uganda
The hazard identified in this assessment is HPAI H5N8. For information regarding AI, please refer to http://www.oie.int/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/HPAI.pdf

Outbreaks caused by H5N8 HPAI viruses have been reported in Asia since 2010. In 2014/15, outbreaks of H5N8 HPAI were reported in Germany, Hungary, Italy, the Netherlands, Sweden and the United Kingdom, and in Canada and the United States. Since the beginning of 2014, several outbreaks involving novel reassortant HPAI A (H5N8) viruses have been detected in poultry and wild bird species in China, the Republic of Korea and Japan.

The viruses have been detected in migratory birds and in domestic chickens, geese and ducks. Since 2016, H5N8 has been detected in 26 European countries, in China, India, Israel and Iran and in Egypt, Nigeria, Tunisia and Uganda (FAO-EMPRES, 2017).

HPAI is a highly infectious viral disease that affects a wide range of bird species. AI viruses that cause HPAI are highly virulent, and mortality rates in infected domestic flocks are often 90 percent–100 percent.

H5N8 human infection and public health
No human cases of infection with H5N8 virus have been detected to date. WHO considers human infections with A(H5) viruses to be rare and generally confined to individuals exposed to sick or dead infected birds or their environments. Although the likelihood of human infection with H5N8 virus is low, the limited information obtained to date suggests that it cannot be excluded (WHO, 2016).

At the time of writing no human cases of H5N8 virus infection had been reported, even though large numbers of people are exposed while managing AI outbreaks. The risk for humans is hence considered very low.

There are few studies of the characteristics of H5N8 HPAI, and only Choi et al. (2017) evaluates the pathogenic potential for mammalian hosts of several H5N8 HPAI strains via mouse-adaptation. This showed that the virus could rapidly reach high virulence within five passages, and acquire several virulence markers. These results suggest that H5N8 HPAI viruses could rapidly acquire virulence markers in mammalian hosts, with consequent spread through repeated viral introduction into hosts, leading to a significant increase in the risk of human infection.

There is no evidence to date of human infection caused by H5N8 HPAI virus, but given its zoonotic potential precautionary measures must be strictly applied to reduce human exposure to all sources of infection.

Profile of the Uganda poultry production system and export market
The total domestic poultry population in Uganda in 2014 was reported at 44.5 million, a 3 percent increase from 2013 (Uganda Bureau of Statistics, 2015). Figure 13 shows that the live poultry population in Uganda and neighbouring countries remained stable in 2013 and 2014.

Of Uganda’s poultry production, 80 percent is free-range birds and 20 percent is intensive commercial rearing. Chickens are the main production type. There are wide variations in the numbers of birds and types and in biosecurity levels, depending on the management system. In 2017, 43 percent of households reported owning ducks and 1.3 percent reported owning turkeys. Commercial production takes place in urban areas where there are markets for eggs and meat. The eastern region is reported to have the highest numbers of free-range birds, accounting for 40 percent of the population. Commercial producers are categorized into four groups:

i. small-scale units categorized as household or family owned farms of 100–500 layers or broilers or indigenous chickens;

ii. medium-scale units owned by individuals, companies or farmers’ groups, with a capacity of 500–5,000 layers or broilers in specialized production; this category also includes farms with a small parent breeding stock and hatching facilities; biosecurity levels are not high;
iii. large-scale units, mainly breeders with hatching facilities and a capacity of over 5,000; and
iv. breeding farms or hatcheries whose main commercial activity is rearing and selling parent stock.

There is little information as to the local marketing of chickens, but it is not a streamlined system. The available market information is mainly informal (FAO, 2008). The main markets for Uganda’s chickens include:

i. informal markets in villages involving farmer-to-farmer or farmer-to-retailer transactions;
ii. primary markets formed by several villages and held on particular days of the week;
iii. secondary markets trading larger numbers of birds; traders usually move the birds by truck; and
iv. markets in towns and cities, supplied by traders who buy birds from secondary markets; they provide poultry for hotels, restaurants and affluent communities.

In some regions small-scale producers market chickens to middlemen who transport the birds to urban traders (Okot, 1990). Middlemen account for 50 percent of the chicken market; other birds are marketed directly from farm households. This trade is the main source of household income for most chicken traders. The demand for chickens is highest in the festive months of December and April, and lowest in February and March. Organized marketing of free-range rural poultry is difficult because of the small and irregular output per household (Chandraschka, 1998). In 2009, 52.9 percent of traders reported that they sourced chickens from eastern Uganda and transported them to markets in passenger vehicles, motorcycles or trucks. Slaughter of poultry in Uganda is mainly carried out in households or restaurants (Enuron et al., 2010).

Live-bird markets are important for poultry marketing in Uganda. Information on the number of such markets is not available, but a study published in 2014 reported 108 live-bird markets in Uganda’s 37 districts. The study refers to lack of consistent management of the marketing of domestic birds, leading to poor biosecurity and elevated risk of disease spread (Kirunda et al., 2014; Kirunda et al., 2015).

The production of eggs and meat from poultry in Uganda and neighbouring countries is summarized in Figure 14. Production of live ducks is highest in Uganda – 1.4 million – and the United Republic of Tanzania – 1.5 million. With regard to exports (see Figure 15), the main markets for poultry and poultry products in 2015 were the Democratic Republic of the Congo and the United Republic of Tanzania for live chickens, the Democratic Republic of the Congo, the Sudan and Rwanda for fresh, preserved or cooked eggs, and South Sudan for yolks and eggs not in shell. Hatcheries import parent “day old chickens” from outside Uganda because there are no grandparent stock farms in the country. Uganda imports from France, Germany, Kenya, Mauritius, the Netherlands, the United Kingdom, the United States and Zimbabwe. The Ugandan Ministry of Agriculture, Animal Industry and Fisheries periodically reviews import requirements for poultry and poultry products and may issue restrictions enforced by law and implemented according to specifications in poultry import permits. No import restrictions have been imposed since the 2016/2017 HPAI events in Europe.

**Uganda AI surveillance and veterinary infrastructure**

Uganda developed its first preparedness and response plan for avian and pandemic influenza in 2005 (United Republic of Uganda. 2006.) 2005 which has been updated in accordance with recommendations from WHO, OIE and FAO.

Over the years Uganda has received support for improving its veterinary infrastructure, laboratory capacities and human resources with a view to increased surveillance for AI (World Bank, 2015). By the end of 2015 the following improvements had been reported:

i. eight sero-prevalence surveys covering HPAI and community-based surveillance systems in the high-risk districts of Busia and Tororo;

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![Graph showing domestic live bird population in Kenya, Rwanda, Uganda, and the United Republic of Tanzania (2013-2014)](image-url)
FIGURE 14. Poultry production in Uganda and neighbouring countries (2013, mt)

List of import markets for a product exported by Uganda in 2015.
Product: 0105 live poultry, “fowls of the species Gallus domesticus, ducks, geese, turkeys and guinea fowls”.

List of supply markets for a product imported by Uganda in 2015.
Product: 0105 live poultry, “fowls of the species Gallus domesticus, ducks, geese, turkeys and guinea fowls”.

Source: ITC Trade Map.

FIGURE 15. Supply markets for poultry products imported and exported from Uganda

Share in Uganda’s imports, %
- >1%
- 1-5%
- 5-10%
- 10-30%
- >30%

Share in Uganda’s exports, %
- N/A
- >1%
- 1-5%
- 5-10%
- 10-30%
- >30%
ASSESSMENT NO. 2

H5N8 HPAI in Uganda

Along the Ugandan shore of Lake Victoria, there are five wetlands listed under the Ramsar Convention (see Figure 17), one of which – Lutembe Bay – hosts 50,000 birds each January; the numbers in 1999-2000 reached 2 million and similar numbers were counted in northern Uganda. There have been fluctuations in the number of water bird species; water birds follow a seasonal pattern, with highest counts from December to March. The largest numbers of birds are Palearctic wintering gulls, terns, waders and white-winged terns (*Chlidonias leucopterus*), accounting for 70 percent of the population (Uganda, State of Birds 2014).

Of the regularly observed migratory birds, eight species are considered high-risk in terms of the spread of AI viruses: these include the tufted duck (*Aythya fuligula*), the long-tailed cormorant (*Microcarbo africanus*), the northern shoveller (*Anas clypeata*), garganey (*Anas querquedula*), the black-headed gull (*Chroicocephalus ridibundus*) and the Eurasian wigeon (*Anas Penelope*).

With regard to the migratory flyways of white-winged terns (*Chlidonias leucopterus*), the breeding areas largely overlap the zones involved in H5N8 HPAI infection in the summer and autumn of 2016 (see Figure 17), which suggests that the species has a role in the recent introduction of H5N8 HPAI into Uganda. Alternative hypotheses such as the involvement of other wild species – *Anatidae* for example – cannot be discarded.

**Uganda’s wild bird population**

Uganda hosts important areas for the breeding, wintering and passage of wild birds; it is a major stopping point on the East Asian-East African flyway (see Figure 16). The region in which the outbreak was reported is a shelter of 240,000 birds including 100 species of migratory water birds of which 82 are Palearctic and 17 Afro-tropical migrants. Along the Ugandan shore of Lake Victoria, there are five wetlands listed under the Ramsar Convention (see Figure 17), one of which – Lutembe Bay – hosts 50,000 birds each January; the numbers in 1999-2000 reached 2 million and similar numbers were counted in northern Uganda. There have been fluctuations in the number of water bird species; water birds follow a seasonal pattern, with highest counts from December to March. The largest numbers of birds are Palearctic wintering gulls, terns, waders and white-winged terns (*Chlidonias leucopterus*), accounting for 70 percent of the population (Uganda, State of Birds 2014).

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Wild bird migration and climate as factors contributing to the spread of AI in Uganda

Uganda has two rainy seasons, one from March to May and one from September to December (UNMA 2016). Migrating wild birds and waterfowl arrive in wintering areas between October and November, during the rainy season when food is abundant, and mix with resident species.

In September and October 2016 there was below-average and erratic rainfall over most of the Democratic Republic of the Congo, Kenya, Rwanda, the United Republic of Tanzania and Uganda, resulting in moisture deficits, degraded ground conditions and drought (see Figure 18). The very dry conditions appear to be associated with the weak La Niña over the equatorial eastern Pacific, which is expected to persist during the early months of 2017. Rainfall anomalies influence phenology and the availability of forage for wildlife, and hence affect migration routes, wintering areas and departure timing for migratory bird species (Gaidet et al., 2008; Hurlbert and Liang et al., 2012, Harris et al. 2013). Like cold spells in temperate regions (Reperant et al., 2010), droughts in tropical areas may lead to high concentrations of wild bird species in available stopping areas and hence increase competition for food and shelter and raise the risk of disease transmission. The current drought around Lake Victoria could have caused a higher congregation of wild bird species at the resting areas where H5N8 HPAI has been reported, with increased risk of virus transmission. Drought may also have reduced the availability of food, hence increasing the vulnerability to disease of migratory and resident bird species.

There is evidence that infected birds can migrate over long distances and carry AI viruses (Keawcharoen et al., 2008; Gaidet et al., 2008). A recent study showed that H5N1 HPAI could spread from central Siberia to Egypt and Sudan along the East Africa-West Asia flyway via the Russian Federation, Iran, Iraq, Lebanon, Israel, the West Bank and Gaza (Liang et al., 2010).

With regard to environmental predictors, in temperate regions cold spells, low temperature and low relative and absolute humidity are major climate determinants of the occurrence of AI. In tropical areas, AI outbreaks are associated with high rainfall and humidity.

Source: FEWS-NET.

REFERENCES


**Annex 2**

**ASSESSMENT METHOD**

**Risk questions**

On the basis of the epidemiological situation in Uganda and the available information, the following risk questions have been addressed:

1. What is the likelihood of H5N8 HPAI spread from Uganda to another countries in the regions?
2. What is the likelihood of further spread of the virus within Uganda?
3. What will be the consequences of the spread of H5N8 in the Uganda’s commercial and backyard poultry production system within the next 6 months?
   - a. What will be the consequences of the spread of H5N8 in the Uganda’s commercial poultry production system within the next 6 months?
   - b. What will be the consequences of the spread of H5N8 in the Uganda’s backyard poultry population within the next 6 months?
4. Which control measures could be put in place to reduce the risk of H5N8 spread in the Region?
   - a. Rank, from the most to the least feasible, the preventive and control options for reducing the spread of H5N8 in the Region.
   - b. Rank, from the most to the least effective, the preventive and control options for reducing the spread of H5N8 in the Region.

For each sub-question a standardised grid was used to gather responses from the experts.

For sub-questions related to question 3, a risk matrix was used to take into account seven different levels of probability and five ranges of possible consequences (Table 2). The final levels of risk were calculated by simply summing the respective likely risk and consequences scores, to give 11 final risk scores, which can be grouped into three risk levels: 0–3 = low; 4–6 = medium; and 7–10 = high (see Table 2).
A simplified probability matrix, which considers the likely risk levels only, was used to gather responses to sub-questions related to questions 1 and 2. The following likelihood levels have been considered: 0 = extremely unlikely 0–1% chance; 1 = very unlikely 1–10% chance; 2 = unlikely 10–30% chance; 3 = as likely as not 33–66% chance; 4 = likely 66–90% chance; 5 = very likely 90–99% chance; 6 = extremely likely 99–100% chance. For sub-questions related to questions 4, tables with five ranking levels were used.

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TABLE 2  Risk matrix used to gather experts’ responses for question 1

A simplified probability matrix, which considers the likely risk levels only, was used to gather responses to sub-questions related to questions 1 and 2. The following likelihood levels have been considered: 0 = extremely unlikely 0–1% chance; 1 = very unlikely 1–10% chance; 2 = unlikely 10–30% chance; 3 = as likely as not 33–66% chance; 4 = likely 66–90% chance; 5 = very likely 90–99% chance; 6 = extremely likely 99–100% chance. For sub-questions related to questions 4, tables with five ranking levels were used.
RISK ANALYSIS IN ANIMAL HEALTH

Risk analysis is a procedure, which we all do intuitively in our everyday life as we also do in our professional work to assess the risk of any hazard or threat. In animal health, risk analysis has been most widely used as a decision tool about the most appropriate health interventions to support disease control strategies, guide disease surveillance and support of disease control or eradication strategies.

It should be remembered that risk is not equal to zero and never stays static. Risks changes as drivers or factors of disease emergence, spread or persistence change such as intensification of livestock production, climate change, civil unrest and changes in international trading patterns. Risk analysis should therefore not be seen as a “one off” activity and it should be seen as a good practice of animal health systems to conduct their regular activities. Therefore, risk analysis process should be repeated and updated regularly.

Risk analysis comprises the following components:

1. **Hazard identification**: the main threats are identified and described.

2. **Risk Assessment**: risks of an event occurring and developing in particular ways are first identified and described. The likelihood of those risks occurring is then estimated. The potential consequences or impact of the risks if they occur are also evaluated and are used to complete the assessment of the risk.

3. **Risk Management**: involves identifying and implementing measures to reduce identified risks and their consequences. Risk never can be completely eliminated but can be effectively mitigated. The aim is to adopt procedures that will reduce the level of risk to what is deemed to be an acceptable level.

4. **Risk Communication**: an integrated processes that involves and informs all stakeholders within the risk analysis process and allows for interactive exchange of information and opinions concerning risk. It assists in the development of a transparent and credible decision-making processes and can instil confidence in risk management decisions.

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