EMPRES
EMERGENCY PREVENTION SYSTEM

Addressing avian influenza A(H7N9)

Qualitative risk assessment update

Issue no. 3

OUTPUTS

The potential spread of the influenza A(H7N9) virus and human exposure

New outputs since the previous preliminary risk assessments published in June 2013 and in January 2014 are highlighted below:

1. The **likelihood** of the influenza A(H7N9) virus **spreading from an infected premise to an uninfected premise within affected areas of China through Live Bird Market (LBM) activities, trade in live birds and trading activities along the market chain as well as illicit movements of live birds and fomites** is currently considered as **high** but expected to decrease and become **low** at the end of the "influenza season" in the northern hemisphere (end of April 2014) and remain as such until October 2014 (pathway 1 on figure 1).

2. The **likelihood** of the influenza A(H7N9) virus **spreading from a known affected area to a "moderate to high-risk" area through LBMs, live poultry movements and informal/illegal movements of birds** is currently considered as **high** but expected to decrease and become **low** at the end of the "influenza season" in the northern hemisphere (end of April 2014) and remain as such until October 2014 (pathway 2 on figure 1).

3. The **likelihood** of the influenza A(H7N9) virus **spreading from a known affected area to a "low risk" area through LBMs, live poultry movements and informal/illegal movements of birds** can be considered **low** (pathway 3 on figure 1).

4. The **likelihood** of a **human becoming exposed** to the influenza A(H7N9) virus transmitted from a **potentially infected bird within affected areas of China** can currently be regarded as **high** but expected to decrease and become **low** at the end of the "influenza season" in the northern hemisphere (end of April 2014) and remain as such until October 2014 (pathway 4 on figure 1).

5. The **likelihood** of the influenza A(H7N9) virus **spreading from a known affected area to a "moderate- to high-risk" area through migratory movements of wild birds** can be regarded as **low**.

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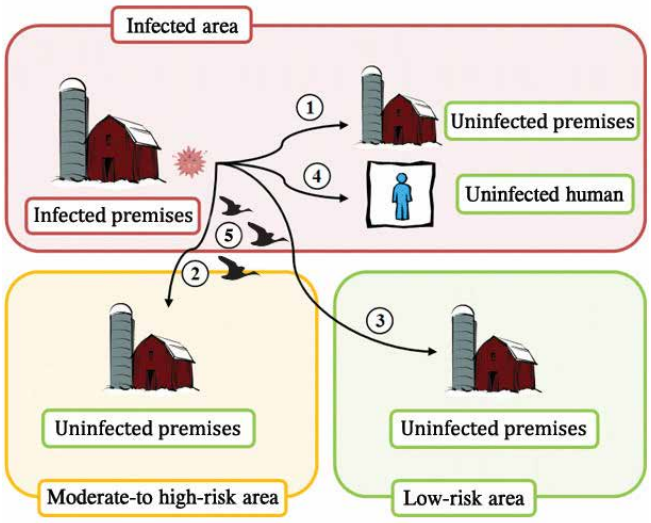
Figure 1
Main Risk Questions Addressed by the Qualitative Risk Assessment



Following the emergence of the novel influenza A(H7N9) in China in March 2013, FAO released an emergency risk assessment in June 2013 using the data available at the time (see http://www.fao.org/docrep/018/aq245e/aq245e.pdf). To assess the effects of the expected increase in poultry trade and consumption associated with the lunar New Year festivities of 31 January 2014, a qualitative risk assessment update was published on 20 January 2014 (see http://www.fao.org/docrep/019/i3631e/i3631e.pdf).[1]

This current and second update is based on information available up to 15 April 2014. The risk assessment update takes into account new epidemiological information (e.g. newly affected Chinese provinces and the detection of influenza A(H7N9) in a tree sparrow), surveillance results (influenza A(H7N9) virus was confirmed in a Chinese poultry farm), and the impact of the upcoming end of the "influenza season" on the different outputs as highlighted in figure 1.[2]

It is important to note that the risk assessment will continue to be revised periodically and as circumstances change.

The background information used to conduct this risk assessment can be found in the Annex at the end of this document.

1. MAIN RISK QUESTIONS ADDRESSED

What is the expected impact of the latest epidemiological and serological information on the influenza A(H7N9) virus and the upcoming end of the "influenza season" in the northern hemisphere (see Annex) on the assessment of:

- the likelihood of the influenza A(H7N9) virus spreading from an infected premise to an uninfected premise within affected areas of China?[3]
- the likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "moderate-to high-risk" area as defined in the emergency risk assessment (see http://www.fao.org/docrep/018/aq245e/aq245e.pdf)?[4]
- the likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "low risk" area as defined in the emergency risk assessment (see http://www.fao.org/docrep/018/aq245e/aq245e.pdf)?
- the likelihood of a human becoming exposed to the influenza A(H7N9) virus through a potentially infected bird within affected areas of China?
- the likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "moderate- to high-risk" area through migratory movements of wild birds?

2. MAIN ASSESSMENT

QUESTION 1. What is the likelihood of the influenza A(H7N9) virus spreading from an infected premise to an uninfected premise within affected areas of China?

Considering that:

- The highest likelihood of spread within already affected areas is associated with the risk pathways that involve LBMs, trade in live birds, illicit movements of live birds, and fomites as defined in the emergency risk assessment (http://www.fao.org/docrep/018/aq245e/aq245e.pdf).
- The virus can be present on an unknown number of poultry farms at an unknown prevalence (i.e. sub-clinical infection). Therefore the presence of the influenza A(H7N9) virus in poultry will remain undetected along the market chain and will not disrupt trade activities, unless sufficiently effective surveillance in healthy-looking birds is performed and mitigation measures taken whenever the virus is detected.
- Though surveillance recently identified the influenza A(H7N9) virus in one Chinese poultry farm, there is still limited data on the level of infection of farms in known affected areas.
- Changes in rules including testing and certification prior to live bird movement and trade over provincial boundaries as well as closure of LBMs may have increased the likelihood for influenza A(H7N9) spreading through illegal commercial activities.
- Most birds detected in LBMs and linked to human infection are meat chickens of the yellow chicken/broiler type, most commonly found in eastern and southern parts of China.
- Many of these farms are involved in integrated systems of meat chicken production where movement of young chickens, people and/or feed represent the most likely source of infection between farms.
- Chickens sent for sale in LBMs are destined for human consumption and while they represent a major source of infection for humans, they pose a lower chance for spread between and among farms. There is, however, a possibility of spreading the virus back to farms through transport vehicles whenever biosecurity measures are not applied.

[1] Lunar New Year refers to the beginning of the year in several calendars. It is based on a lunar calendar or a lunisolar calendar. It is known as Chinese New Year in China, or Tet New Year in Viet Nam.

[2] "Influenza season" refers to a period of high influenza activity in animals and humans associated with colder temperatures.

[3] An infected premise is defined as any premise containing infected live poultry (e.g. LBMs, transportation trucks, poultry farms, etc.).

[4] Moderate-risk areas or countries are unaffected areas or countries that import live birds or bird products from areas or countries that import such products from at least one infected area or country and/or that have seasonal migration stopover sites of wild bird species known to be the main natural reservoir of low pathogenic avian influenza (LPAI) viruses. The cross-border trade of live birds and bird products may include historical or existing, formal or informal trading activities. High-risk areas or countries are unaffected areas or countries that share a land border with at least one infected area or country or that have formal or informal imports of live birds or bird products including historical trading activities with at least one infected area or country.

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- Influenza A(H7N9) seems to follow a seasonal pattern according to preliminary analysis of data available to date. Circulation of seasonal influenza viruses in known affected areas will likely decrease at the end of April 2014 as temperatures rise and as the "influenza season" comes to an end, and remain at a low level until October 2014.
- Based on past experience with H5N1 and H7N9, the level of new infections within already affected areas through the risk pathways involving LBMs, trade in live birds, illicit movements of live birds and fomites might tend to decrease since live bird trade is expected to return to its pre-lunar New Year and pre-Qingming levels.

Therefore, the likelihood of the influenza A(H7N9) virus spreading from an infected premise within affected areas of China through the risk pathways identified in the emergency risk assessment can currently be regarded as **high**, as formerly assessed. (http://www.fao.org/docrep/018/aq245e/aq245e.pdf).

This likelihood should then decrease to become **low** at the end of the "influenza season", expected at the end of April 2014, and remain as such until October 2014.

QUESTION 2. What is the likelihood of the influenza A(H7N9) virus spreading from a known affected area to "a moderate to high-risk" area?

Considering that:

- The highest likelihood of the influenza A(H7N9) virus spreading to poultry within these regions is associated with live poultry movements, trade through LBMs and informal or illegal movements of birds.
- Based on past experience with H5N1 and H7N9 (without knowing the exact mechanism involved), influenza A(H7N9) seems to follow a seasonal pattern according to preliminary analysis of data available to date. Circulation of seasonal influenza viruses in known affected areas will likely decrease at the end of April 2014 as temperatures rise and as the "influenza season" comes to an end, and remain at a low level until October 2014.

The likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "moderate to high-risk" area through these risk pathways can currently be considered **high**, as assessed in the emergency risk assessment (see http://www.fao.org/docrep/018/aq245e/aq245e.pdf).

This likelihood should then decrease to become **low** at the end of the "influenza season", expected at the end of April 2014, and remain as such until October 2014.

QUESTION 3. What is the likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "low risk" area?

Considering that:

- By definition, a low-risk uninfected country or area does not trade directly with affected or high-risk unaffected countries or areas.

The likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "low risk" area through trade can be considered **low**, as assessed in the emergency risk assessment (http://www.fao.org/docrep/018/aq245e/aq245e.pdf).

The likelihood of the virus spreading through trade remains highly dependent on: i) the regulatory frameworks effective in low-risk areas or countries; and ii) the level of illegal trade, if any.

QUESTION 4. What is the likelihood of a human becoming exposed to the influenza A(H7N9) virus spreading from a potentially infected bird within affected areas of China during the specific time?

Considering that:

- Trading activities of poultry in Eastern and Southern China are back to their pre-lunar New Year and pre-Qingming levels.
- Infection in poultry still remains undetected due to lack of clinical signs.

- Epidemiological investigations indicate that human infection or cases appear to be associated with direct or indirect contact with live bird species, especially in a LBM or in relation to poultry transport, handling and/or slaughtering activities.
- There has been increased attention to improve biosecurity in LBMs in the main cities of previously most affected provinces (e.g. Jiangsu, Shanghai and Zhejiang). This appears to have reduced the number of new human cases in the last months. However, biosecurity and prevention measures in other areas appear to be variable and in some places very limited. And illegal trade activities increase uncertainty in relation to the probabilities of spreading.
- Based on past experience with H5N1 and H7N9 (without knowing the exact mechanism involved), influenza A(H7N9) seems to follow a seasonal pattern according to preliminary analysis of data available to date. Circulation of seasonal influenza viruses in known affected areas will likely decrease at the end of April 2014 as temperatures rise and as the "influenza season" comes to an end, and remain at a low level until October 2014. Retaining the levels of awareness and biosecurity will limit human exposure to any levels of viral circulation.

The likelihood of a human becoming exposed to the influenza A(H7N9) virus transmitted from a potentially infected bird within affected areas of China can be regarded as **high**, as formerly assessed in the emergency risk assessment (http://www.fao.org/docrep/018/aq245e/aq245e.pdf).

This likelihood is expected to decrease and become **low** at the end of the "influenza season", expected at the end of April 2014, and remain as such until October 2014.

QUESTION 5. **What is the likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "moderate to high-risk" area through migratory movements of wild birds?**
Considering that:

- The influenza A(H7N9) virus has been detected lately in one tracheal sample from a healthy tree sparrow out of 2198 fecal, tissue, cloacal and tracheal swab samples from healthy and naturally dead wild birds in Shanghai in spring 2013.
- The influenza A(H7N9) virus is expected to be found in other bird species than the ones used for food production. The susceptibility of those different species to infection given viral exposure is being assessed. The ability of those different species to spread the virus to other species still needs to be assessed.
- Unlike the patterns previously described for other influenza viruses, there is currently no epidemiological evidence indicating that migratory wild birds have a role in the spread of influenza A(H7N9). So far, virus spread appears to only have been associated with poultry movement and related commercial activities.
- Movement of wild birds has been associated in the past with the spread of Low Pathogenic Avian Influenza (LPAI) and Highly Pathogenic Avian Influenza (HPAI) in poultry. Infection of wild birds with influenza A(H7N9) could happen and would remain undetected until it reaches poultry farms, LBMs and finally leads to human infections. This probability will have to be better reassessed once scientific data becomes available regarding the susceptibility of different wild bird species to infection with influenza A(H7N9) virus, their ability to shed virus and their ability to transmit the virus to poultry.

The likelihood of the influenza A(H7N9) virus spreading from a known affected area to a "moderate- to high-risk" area through migratory movements of wild birds can be regarded as **low**.

3. MITIGATION MEASURES AVAILABLE

The risk management measures applied by the Chinese authorities since the beginning of the event mitigate the risk of human exposure to the influenza A(H7N9) virus in LBMs and the spread of this virus through trading activities, but do not eliminate it. Thorough epidemiological investigations need to continue in order to identify where the virus is circulating in locations other than LBMs, as well as to understand why human infections with the virus are still occurring despite the measures taken in markets to reduce this risk. Increased surveillance at farm level will be necessary to ensure that poultry going to markets are not coming from infected farms.

The following risk mitigation measures are recommended to be implemented by poultry producers, marketers and consumers.

Mitigation measures reducing the likelihood of the influenza A(H7N9) virus spreading from an infected farm/unit to an uninfected farm/unit within affected areas of China and from a known affected area to a "moderate- to high-risk" area

- Applying strict biosecurity measures in LBMs including:
  - » Ensuring that the sources of poultry for live poultry markets are free from virus and that appropriate tracing systems and certification systems are in place. In many areas this is not possible at present.
  - » Reducing transit times of poultry in markets below the incubation period of the virus to limit the likelihood of viral excretion and further human exposure by sub-clinical infection. (Pantin-Jackwood *et al.,* JVI, doi:10.1128/JVI.03689-13).
  - » Implementing regular market rest days with appropriate cleaning and disinfection. Monitor markets for effectiveness of disinfection, using regular consistent monitoring for virus, collecting environmental samples just before and just after rest days. Rest days are only effective if an entirely new batch of poultry is introduced rather than just removing birds temporarily and returning them subsequently.
  - » Regular cleaning of markets with detergent and water (see the FAO Guide on Risk Management Along the Market Chain - http://www.fao.org/docrep/018/aq241e/aq241e.pdf).
  - » Cleaning by trained staff wearing appropriate personal protective equipment (PPE) to be conducted when the market is closed and no customers are present.
- Placing strict controls on cross-border movements of poultry at provincial and national levels.
- Keeping different types of birds and other species of domestic animals separate from each other. Screens, fencing or nets can be used to separate species from each other and help prevent possible transmission.
- Limiting access of wild birds to poultry or other domestic animals. Even though there is no current evidence to implicate wild birds in the spread of influenza A(H7N9), this is considered good biosecurity practice.
- Reporting sick or dead animals to the local veterinary or public health authorities. If this is not possible, informing

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community leaders. Even though influenza A(H7N9) does not currently cause illness in poultry, H5N1 and other highly pathogenic avian influenza viruses do, and it remains important that all signs of illness or sudden and unexplained deaths in poultry, farmed birds, wild birds or other animals are reported to the authorities and appropriately investigated and handled. Other than influenza A(H7N9), other H7 viruses have been shown to be able to mutate into HPAI with associated high mortality in terrestrial poultry.

- Not feeding sick or dead animals to other animals.

Mitigation measures reducing the likelihood of human infection with the influenza A(H7N9) and other influenza viruses transmitted from a potentially infected bird within an affected area.

- Close contact with infected animals can put people at risk. Since influenza A(H7N9) virus was not reported to cause clinical signs in infected poultry, it is crucial to have separate living areas for animals and humans and to prefer official slaughtering of animals to slaughtering of animals in non-dedicated professional areas (e.g. at home). Seek immediate medical advice if signs of fever appear within a few days after contact with poultry, farmed birds, wild birds or other animals.
- Wash your hands often. You should always do so after handling birds or other animals, as well as before and after preparing food and before eating.
- Observe good hygiene practices including: i) keeping raw meat separate from cooked or ready-to-eat foods to avoid cross-contamination; ii) using separate utensils to prepare raw meats and other foods (e.g. chopping boards and other surfaces, knives, and plates); and iii) washing and disinfecting all surfaces and utensils that have been in contact with raw meat.
- Eat only well-cooked meat products (food needs to reach 70° C or more in all parts). Influenza and other viruses or bacteria are not transmitted through consumption of well-cooked food. As a general food safety rule, the consumption of raw meat and uncooked blood-based dishes is a high-risk practice.
- Do not prepare and/or eat sick or dead animals and do not give or sell them to others.

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ANNEX
BACKGROUND ON INFLUENZA A(H7N9) ON 15 APRIL 2014

- On 31 March 2013, Chinese authorities reported the identification of a new strain of influenza in three persons displaying flu-like symptoms in Shanghai municipality and Anhui province. All three patients died from the infections. This particular strain of virus, subsequently named influenza A(H7N9), had never been identified in humans or poultry prior to this event.
- From 31 March 2013 to 20 January 2014, a total of 209 laboratory confirmed human cases and one asymptomatic human case found via active surveillance were reported by Chinese health authorities; 55 of these were fatal. The cases were reported from 15 provinces or municipalities, including Anhui, Beijing, Fujian, Guangdong, Guizhou, Hebei, Henan, Hunan, Jiangsu, Jiangxi, Shandong, Shanghai, Zhejiang and Taiwan Province and Hong Kong SAR. Most of the patients were reported to have had contact with poultry, either during market visits, slaughter (at home) or transportation activities, prior to the onset of their illness.
- Between 20 January 2014 and 15 April 2014, 212 additional laboratory-confirmed human cases were found and two new Chinese provinces were reported as infected (Jilin and Guangxi) and confirmed in one Chinese tourist travelling to Malaysia.
- Infection of poultry does not produce any clinical signs. Various challenge-studies provided information on relative susceptibility and levels of shedding by various avian species (Miller *et al.,* 2013; Pantin-Jackwood *et al.,* 2014). A recent paper also suggested that the A(H7N9) virus spread at a low transmission rate between chickens (Kang *et al.,* 2014).
- Since March 2013, the Chinese authorities have detected the influenza A(H7N9) virus in surveillance samples mostly from chickens, ducks, pigeons (captive-bred and feral) and market environments, mainly at LBMs linked to human cases. Reports indicate that none of the birds testing positive showed clinical signs of infection. Measures, including temporary market closures, culling of birds, cleaning and disinfection, were taken at LBMs following virus detection.
- Surveillance activities are continuing, including environmental and poultry sampling in LBMs (identified as a major exposure site in reported human infections) and poultry sampling at the farm level as well as wild bird surveillance. Although surveillance results published to date by the Ministry of Agriculture do not suggest a particular high viral circulation within affected areas, uncertainties regarding the representativeness of these results remain. A further targeted surveillance may be needed in order to better assess the actual levels of viral circulation in susceptible animal species.
- A distinct reservoir for the influenza A(H7N9) virus has not yet been identified. Temporary closure of live poultry markets has resulted in a marked reduction in new human cases suggesting that live poultry were an important source of infection for humans (Cowling *et al.,* 2013). Case-control studies suggest that contact with live poultry within two weeks before the onset of clinical signs was a significant risk factor. The virus has been detected in LBMs linked to human cases (Cui *et al.,* 2014). Cases have occurred in patients transporting and handling live poultry and slaughtering poultry at home.
- So far, no sustained human-to-human transmission has been reported by the World Health Organization (WHO).
- Significant changes have been implemented in LBMs varying within and between provinces. Measures include short-term closure of markets for regular poultry-free rest days, enhanced cleaning and disinfection, as well as temporary closures and depopulation, whenever the influenza A(H7N9) virus is detected. The effects of these measures need to be considered in the assessment of likely effects of the seasonal increases in trade in poultry. There are risk factors which are yet to be understood, since in places such as Guangdong, where market rest days have been implemented, human cases are still occurring, whereas in other places, such as Shanghai and Zhejiang, no new human cases have been reported as of late.
- A recent article from a surveillance study conducted in the Spring of 2013 on 2 198 fecal, tissue, cloacal and tracheal swab samples from wild birds (both live and naturally dead) led by the Shanghai Municipal Center for Disease Control and Prevention identified only one tracheal sample from an apparently healthy tree sparrow positive for the influenza A(H7N9) virus (Zhao *et al.,* 2014).

NOTES

CONTACT

The Emergency Prevention System (EMPRES) is an FAO programme, founded in 1994, with the goal of enhancing world food security, fighting transboundary animal and plant pests and diseases and reducing the adverse impact of food safety threats. EMPRES-Animal Health is the component dealing with the prevention and control of transboundary animal diseases (TADs).

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EMPRES-Animal Health can assist countries in the shipment of samples for TAD diagnostic testing at a FAO reference laboratory and reference centre. Please contact **Empres-Shipping-Service@fao.org** for information prior to sampling or shipment. Please note that sending samples out of a country requires an export permit from the Chief Veterinarian's Office of the country and an import permit from the receiving country.

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This summary of the preliminary risk assessment is based on the information available to date and will be reviewed as new findings emerge from field investigations, laboratory testing and epidemiological studies at both the animal and human levels.

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