EMPRES
EMERGENCY PREVENTION SYSTEM

Addressing avian influenza A(H7N9)

Guidelines for emergency risk-based surveillance

Issue no. 1

Contents

SUMMARY

To maximize the likelihood of detecting circulation of the low pathogenic avian influenza (LPAI) A(H7N9) virus in birds, a risk-based surveillance strategy is recommended for investigating the presence of the infection along the market chain, upstream from live bird markets (LBMs), to farm types and production units.

The overall objective of risk-based surveillance for H7N9 is to assist national authorities in controlling the spread of infection along poultry market chains and to facilitate the rapid detection of an incursion of H7N9 in non-affected countries or areas. It also aims to improve understanding of the ecology and epidemiology of the virus in domestic bird populations, its geographic distribution, species susceptibility, and the characteristics of affected markets and farming systems. Surveillance will facilitate the genetic characterization of circulating virus, enabling investigation of the evolution of the H7N9 virus.

The proposed surveillance strategy varies according to the status of infection in an area or country. In infected areas/countries, highly connected LBMs that act as hubs in live poultry trade networks[1] should be identified, selected and sampled. To increase the likelihood of detecting circulating virus, the LBMs that are most likely to become contaminated/infected should be selected. The detection of circulating viruses in these selected LBMs will trigger investigations in the geographic regions supplying LBM traders (the catchment areas). In the catchment areas, markets and the production units that supply them should then be sampled according to a predefined probability-based scheme.

Uninfected areas and countries are categorized as being at high, moderate or low risk of infection. Although the specific measures suggested for each risk category vary, the aim of the surveillance strategy in any uninfected area or country is the early detection of virus incursion. The following approaches are suggested: i) enhanced surveillance at points of entry for live poultry and poultry products (LBMs with high imports and/or border control points); and ii) risk-based surveillance along the market chain. To assess whether the H7N9 virus has already been circulating within domestic or wild bird populations, historical samples collected from poultry in the framework of H5N1 highly pathogenic avian influenza (HPAI) surveillance may be tested.

1 Networks provide a conceptual framework for representing and studying the relationships among elements of a system. A network consists of a set of nodes and a set of edges that link all or some of the nodes together. For surveillance of the H7N9 virus, the nodes would be markets and farms, and the edges would be represented by the movements of animals or traders among these markets and farms.

In the medium to long term, it is recommended that all countries (infected or uninfected) conduct a survey of the movements of commercial live poultry and traders to define the associated networks. The network characteristics that are relevant for informing risk-based surveillance would then be determined using social network analysis, to identify specific LBMs or other premises that are central in the networks, where rapid detection of virus incursion is most likely. Early warning systems based on the monitoring of health and non-health variables (syndromic surveillance) should be developed for the early detection of any abnormal variation that may be linked to the emergence or modified virulence characteristics of a pathogen. In industrial poultry production systems, production variables such as a drop in egg production, mortality or reduced feed and water consumption are important indicators of the introduction of pathogens. Good recording systems are required to define a baseline and monitor significant changes in these variables.

1. OBJECTIVES OF SURVEILLANCE

As H7N9 is an LPAI virus with zoonotic characteristics, the main concern is currently its potential for "silent" infection in birds, which increases the risk of incursion, spread and public health concerns. Another concern is that continued circulation of this LPAI virus in domestic poultry may lead to the evolution in the HA gene that results in the emergence of highly virulent strains of the avian influenza H7N9 virus.

The overall objective of these guidelines for risk-based surveillance strategies for avian influenza A(H7N9) virus is to assist the national authorities of infected countries in controlling the spread of infection along poultry market chains, and to facilitate rapid detection of an incursion of H7N9 in domestic birds[2] and other susceptible species of non-affected countries or areas. Surveillance will also enable an enhanced understanding of the epidemiology, ecology and geographic spread of the virus in domestic bird populations, and the identification of susceptible species and affected markets or farming systems. These data will reduce the uncertainty associated with risk assessments, thereby enabling the development of more effective control strategies.

The specific objectives of the risk-based surveillance strategy will vary according to the epidemiological status of infection in an area or country.

For infected areas or countries, these objectives are to:

- » determine the geographic extent of virus circulation in domestic poultry in infected areas;
- » identify affected farm types, market types and susceptible domestic bird species in different geographic areas;
- » identify other susceptible animal species.

For areas or countries assumed to be uninfected – which are categorized as being at high, moderate or low risk of infection – the objectives are to:

- » determine whether the avian influenza A(H7N9) virus has already been circulating within domestic or wild bird populations;
- » enhance early detection of the virus's incursion into the domestic bird population.

Areas and countries are epidemiologically classified as infected or uninfected according to the following criteria:

- *Infected areas or countries* (from an epidemiological point of view) are those where at least one positive case of avian influenza A(H7N9) has been detected by virological tests in birds (domestic, feral or wild), humans (other than isolated imported cases) or other animals. The boundaries of these areas should be determined by epidemiological considerations, but given the limited knowledge currently available may have to be based on administrative boundaries (e.g., districts, provinces).
- *Uninfected areas or countries* are those for which there is no evidence of avian influenza A(H7N9) virus circulation in birds (domestic, feral or wild), humans or other animals. These areas or countries can be differentiated into high-, moderate- and low-risk categories according to the likelihood of virus incursion. This risk classification is based on geographic proximity to infected countries/areas, known patterns of legal and informal/illegal cross-border trade in live domestic birds and bird products, and the migration patterns of wild bird species known as the main natural reservoir of avian influenza viruses (waterfowl, shorebirds):
  - *High-risk areas or countries* are uninfected areas or countries that share a land border – or have existing

2. The proposed risk-based surveillance strategy is not designed to investigate the sources of and risk factors for human infection, but rather focuses on identifying virus circulation in birds.

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or historical, legal or illegal trade in live birds or bird products – with at least one infected area or country.
  - *Moderate-risk areas or countries* are uninfected areas or countries: i) that import live birds or bird products from areas or countries that import live birds or bird products from at least one infected area or country; and/or ii) that are connected to an infected area or country through the migration routes and stopover sites (depending on the season) of wild bird species known as the main natural reservoir of LPAI viruses. The cross-border trade of live birds and bird products may include historical or existing, legal or illegal trading activities.
  - *Low-risk areas or countries* are the uninfected areas or countries that are not classified as high- or moderate-risk.

2. RISK-BASED SURVEILLANCE STRATEGY

The priorities of the surveillance strategy will depend on the infection status and risk of introduction of infection into the area/country concerned.

- *Infected areas or countries* should prioritize:
  - risk-based surveillance along the market chain;
  - improved preparedness and response.
- *High-risk uninfected areas or countries*: As it is impossible to monitor all the pathways for potential virus incursion, surveillance activities should concentrate on early detection of current or recent virus circulation in live poultry trade networks (which are considered to be the most important risk pathway for spread):
  - surveillance at the points of entry of live birds and poultry products from infected areas/countries;
  - risk-based surveillance along the market chain;
  - retrospective surveillance based on biological samples collected previously;
  - improved preparedness and response.
- *Moderate-risk uninfected areas or countries* should prioritize:
  - surveillance at the points of entry of live poultry and poultry products from infected areas;
  - risk-based surveillance along the market chain;
  - improved preparedness and response.
- *Low-risk uninfected areas or countries* should prioritize:
  - improved preparedness and response.

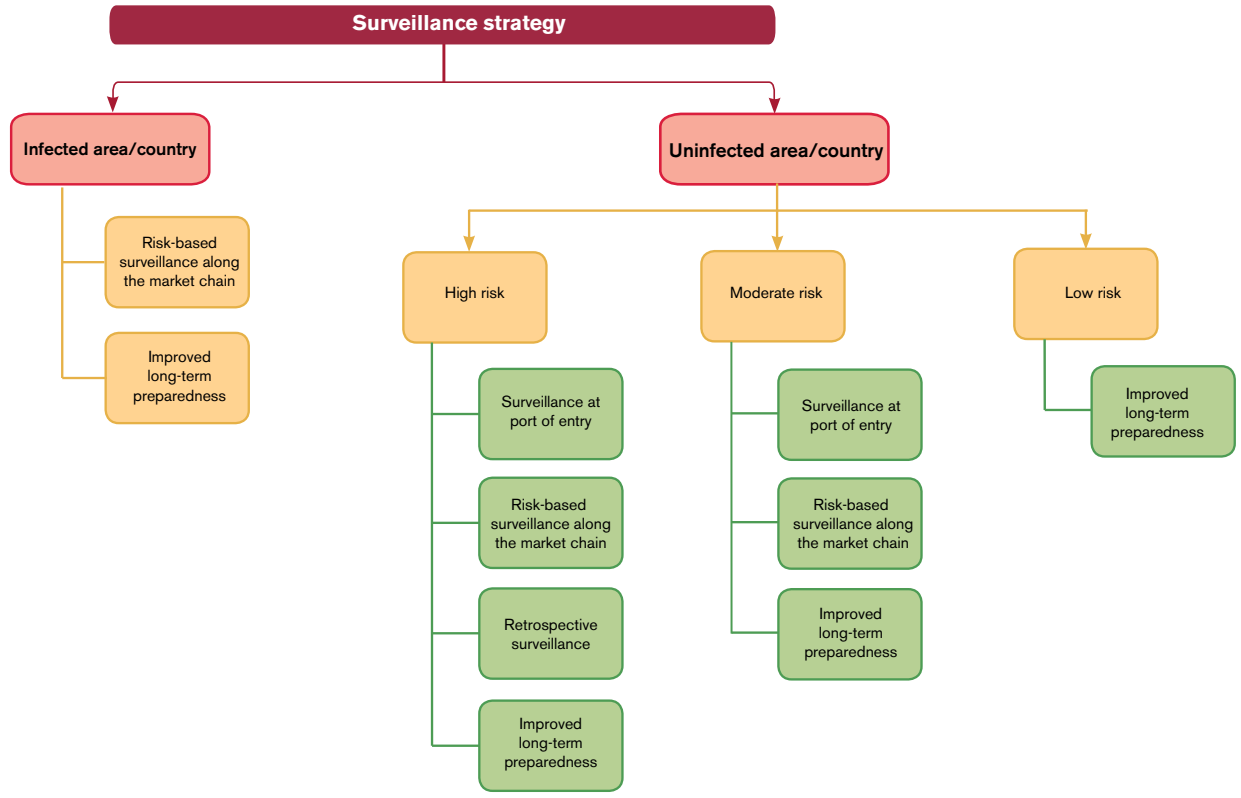
To establish efficient and effective risk-based surveillance in the poultry sector, it is necessary first to understand the poultry trading networks, especially those involving LBMs, and to identify LBMs with a central role in these networks. The data necessary for mapping networks and trade volumes should be collected, and poultry producers should be encouraged to monitor the production indicators of health and to report significant changes to animal health services. This activity, which contributes to long-term preparedness for avian influenza virus emergencies, should be undertaken in infected as well as uninfected high- and moderate-risk countries.

2.1. Risk-based surveillance along the market chain

To maximize the likelihood of identifying the sources of the virus in the market chain, a risk-based surveillance strategy that tracks the infection along the chain, from LBMs to farm types and production units, should be adopted (see Annex 1):

- *Step 1:* Initial surveillance should be conducted in LBMs, as these have frequently been shown to be contaminated

Figure 1: Prioritization chart



with avian influenza viruses (Shortridge *et al.*, 1998; Choi *et al.*, 2005; Liu *et al.*, 2011). At the time of writing, avian influenza A(H7N9) has mostly been detected in LBMs in the People's Republic of China The likelihood of identifying contamination of an LBM is influenced by: i) the likelihood of that LBM becoming contaminated/infected (and therefore becoming a source of infection for birds); and ii) the likelihood of the LBM amplifying and sustaining virus circulation (and therefore becoming a reservoir of infection).

The LBMs with the highest probability of becoming contaminated/infected are generally those that are most highly connected in live bird trade networks. These LBMs are congregation points, so they accumulate a large proportion of the commercial live birds moving within the trade network of an area/country at risk or already affected. They gather many different bird species from different production systems and geographic areas, and so are likely to reflect the general bird population. Initial surveillance in LBMs will guide targeted upstream surveillance of farm types and production units.

- *Step 2:* For each LBM in which the virus has been found, or that has tested seropositive, the geographic region supplying market traders (the catchment area) should be defined. Within this catchment area, sampling should be undertaken in markets and in the farm types/production units that supply the LBMs found to be positive in step 1.
- *Step 3:* For LBMs and production units found to be contaminated or seropositive in step 2, their connections with other LBMs and farm types should be investigated, to detect the presence of the virus beyond the catchment areas of the LBMs selected in step 1. A serological survey should be conducted in the areas surrounding farms identified as infected, to assess the extent of local virus spread and the risk factors associated with infection.

Step 1: Live bird market survey

Sampling frame

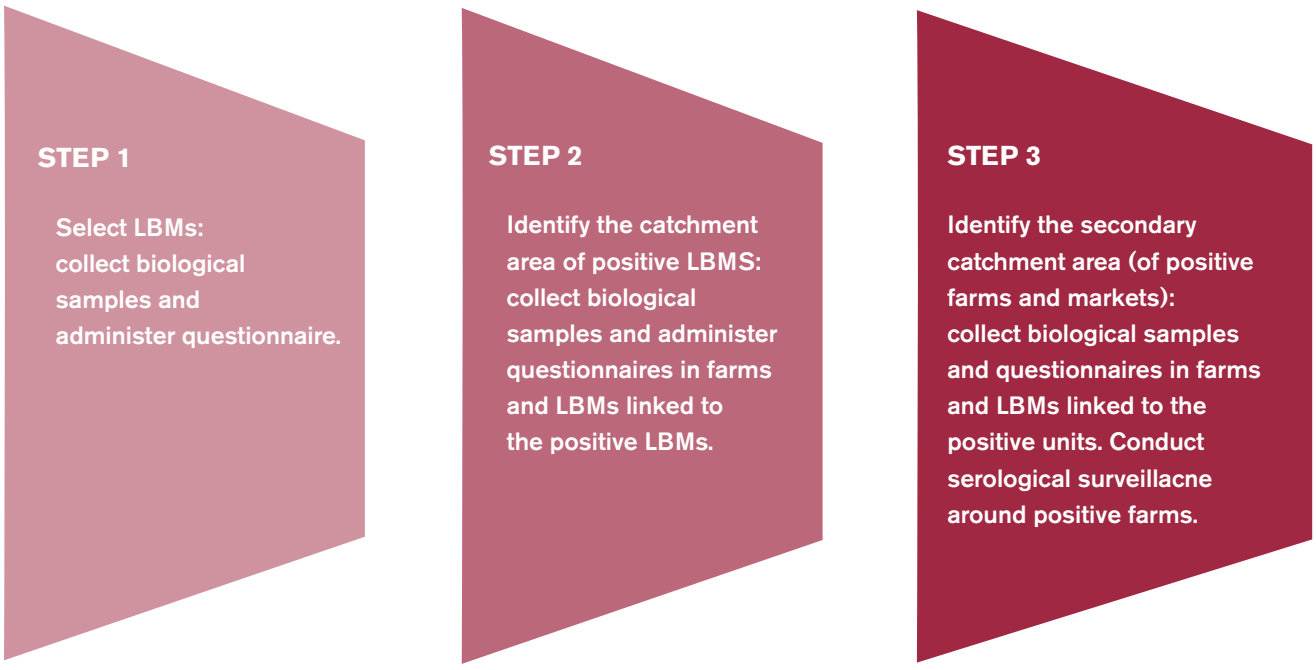
The LBMs with the highest likelihood of becoming contaminated are those that are the most highly connected in the live bird trade network. Ideally, these LBMs should be identified using social network analysis[3] following a network survey based on a snowball sampling strategy (Wasserman and Faust, 1994), as described in subsection 3.1. In an emergency situation, historical data may be used, with market selection based on the following criteria:

- markets with the most poultry sellers or poultry sold[4] within a given administrative unit (Martin *et al.*, 2011; Fournié *et al.*, 2013) – administrative units can be districts, provinces or their equivalents; if detailed information on markets is not available, it can be collected through participatory group discussions with local district or provincial authorities and market stakeholders such as market managers;
- markets that have been repeatedly contaminated by other influenza A viruses in the past;
- markets suspected of being a source of infection for human cases of avian influenza A (H5N1, H7N9);
- market biosecurity practices – low biosecurity and poor implementation of disinfection and hygiene measures, unsold birds reoffered for sale the following day (Fournié *et al.*, 2012), no segregation of bird species, etc.

In areas where LBMs are not a major feature of the poultry production system, and are therefore unlikely to mediate a significant proportion of live bird trade activities, other congregation points can be targeted, such as large slaughterhouses or slaughtering points supplied with large numbers of birds from various geographic origins.

3. A methodology for providing mathematical characterization of the relationships among entities – in this case markets and farms – in the network of interest.
4. Numbers of sellers and birds sold can be used as a proxy for assessing market connectivity.

Figure 2: Design process for risk-based surveillance along the market chain, based on a snowball sampling strategy



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Sample size

The number of LBMs to be selected for sampling varies according to the size of the province (or equivalent) and the resources available. If possible, at least ten markets should be sampled per province (or equivalent) within an infected country or area.

For LBM surveys in uninfected areas or countries, sampling efforts may be reduced because the objective is to detect the presence of the virus at the national/area level rather than the provincial level; the surveillance strategy should therefore target the main LBMs at the area or country level. Samples collected for H5N1 HPAI virus surveillance in LBMs in uninfected areas/countries classified as being at high risk of infection could also be tested for H7N9. If the original sampling focused on ducks, the range of species should be extended to include other domestic birds, especially chickens and quails. Further details on sample types and pooling are provided in following subsections.

Questionnaire survey

All the market traders should be interviewed, to identify the market chain links and, therefore, the catchment area for the market. Structured interviews with traders should capture information on numbers of birds supplied, geographic origins of birds, bird species, types of supplying farming system, and locations of supplying LBMs (see sample questionnaires in Annex 2).

Sample types

As the main host reservoir for avian influenza A(H7N9) has not been identified, all species should be included in the sample collection, including ornamental/song birds. The main shedding route –respiratory or intestinal –is known for some species but remains unknown for others at the time of writing, so both environmental and bird samples should be collected.

Environmental samples: Environmental swabs should be collected from the following sample locations (Indriani *et al.*, 2010; Horm *et al.*, 2013): i) tables where birds are displayed (or meat containers); ii) moist areas of baskets holding bird parts; iii) waste bins containing wet poultry waste; iv) processing tables (after de-feathering); v) wet cloths/rags; and vi) birds' drinking-water. The pooling of samples in batches of five is acceptable, as long as samples from different locations and environments (drinking-water and table tops, for instance) are not pooled together.

Live birds: Currently available data show that quails shed the most virus, followed by chickens and geese. Ducks and pigeons seem to have limited or no virus shedding post-infection. The main shedding route seems to be oropharyngeal rather than cloacal (Southeast Poultry Research Laboratory and St. Jude Medical, personal communication). A focus on oropharyngeal swabs from chickens, quail and geese is recommended. Although ducks seem to shed less, swabbing is still recommended, but lower priority can be given to laboratory testing of the samples. The birds sampled should be representative of the overall live bird population in the market, and include all the species present.

Given the low isolation rates of LPAI reported in the literature (Choi *et al.*, 2005; Liu *et al.*, 2003), the low isolation rates observed in ongoing studies of H7N9 (by China's Ministry of Agriculture), and the likelihood that virus circulation is asymptomatic in marketed birds, the expected detection rate[5] used to compute the total sample size is assumed to be lower than 5 percent, with at least 60 birds per market.[6]

Pooling of samples in batches of five is acceptable, as long as environmental, oropharyngeal and cloacal samples, and samples from different species, are kept separate.[7] Samples from dead birds or birds showing clinical signs, including LPAI signs (depression/lethargy, decreased consumption, decreased egg production, decreased fertility and hatchability of eggs, misshapen eggs and increased mortality) (Spickler, Trampel and Roth, 2008), should not be pooled. For each sample, the sampling data listed in Annex 4 should be recorded.

Where possible, blood samples should be collected from live birds, as serological testing increases the likelihood of obtaining evidence of past infection. As the sellers of live birds may be reluctant to allow the collection of blood samples, blood from slaughtered birds can be collected instead. In the absence of

5. The detection rate is the proportion of animals expected to be found positive when randomly sampled from an infected population. It depends on the expected prevalence and the test characteristics.
6. This sample size is calculated for an infinite population size and a confidence limit of 95 percent.
7. Faecal material may inhibit polymerase chain reaction (PCR) and cloacal swabs should therefore always be stored separately

knowledge regarding seroprevalence in birds, the detection rate[8] used to compute the total sample size is assumed to be lower than 5 percent, with at least 60 birds.

The birds collected from slaughter points might not be representative of the overall live bird population in the market. Therefore, the birds used for swab and blood collection need not be the same.

A market is considered positive if at least one sample or pool of samples – environmental, oropharyngeal or cloacal – is found positive according to the virological diagnostic test. A market (or slaughter point) is also considered positive if at least one positive H7 haemagglutinin inhibition (HI) case is found and confirmed by a neuraminidase (NA)-N9 positive test (recommendations for laboratory testing are provided by the OIE/FAO Network of Expertise on Animal Influenza [OFFLU]).

Step 2: Catchment area survey

Sampling frame

The catchment area of positive LBMs should be defined from interviews with traders. In each administrative unit of the catchment area, every other market and every farm type found to supply LBMs should be listed.

When selecting farm types, the administrative unit should ideally be of a lower level than that used for selecting LBMs in step 1, for example, if LBMs are selected at the province level, then farm types should ideally be selected at the district or commune level. Definitions of farm types depend on the production system(s) considered (e.g., intensive production systems, village poultry, etc.) and may therefore vary among areas or countries. The criteria for defining farm types should include, at a minimum, number of birds, bird species and breed, housing system (e.g., free-range, indoor) and production type (e.g., layer, broiler, breeder). The markets identified as poultry suppliers of the positive LBM should be sampled, as described in step 1.

Priority should be given to the administrative units, farm types and markets that supply the most birds to the market. As there is no information about the variation in infection risk among farm types, bird species and geographic areas, the expected prevalence used for sample calculation has to be assumed to be homogeneous across all catchment areas and farm types.

To increase precision, sampling is stratified by administrative area and farm type. Therefore, the numbers of markets and farms visited in each farm type and administrative unit within the catchment area should be weighted by the number of birds supplying the market originating from that farm type/administrative unit (Figure 3). If resources are limited, efforts should focus on the farm types and administrative units that are responsible for the most market supplies. Farms should be randomly selected within each administrative unit and farm type.

Sample size

The virus detection rate at the farm level is expected to be an extremely low percentage, meaning that at least 150 farms should be sampled within the catchment area of each market.[9]

Questionnaire survey

Information about potential infectious contacts with other farms and LBMs should be collected from each sampled farm. Potential infectious contacts include movements of live animals and fomites – such as visits to the farm by traders – and other farmers (see Annex 3). When a farm is found to be positive, this information will inform step 3.

Sample types

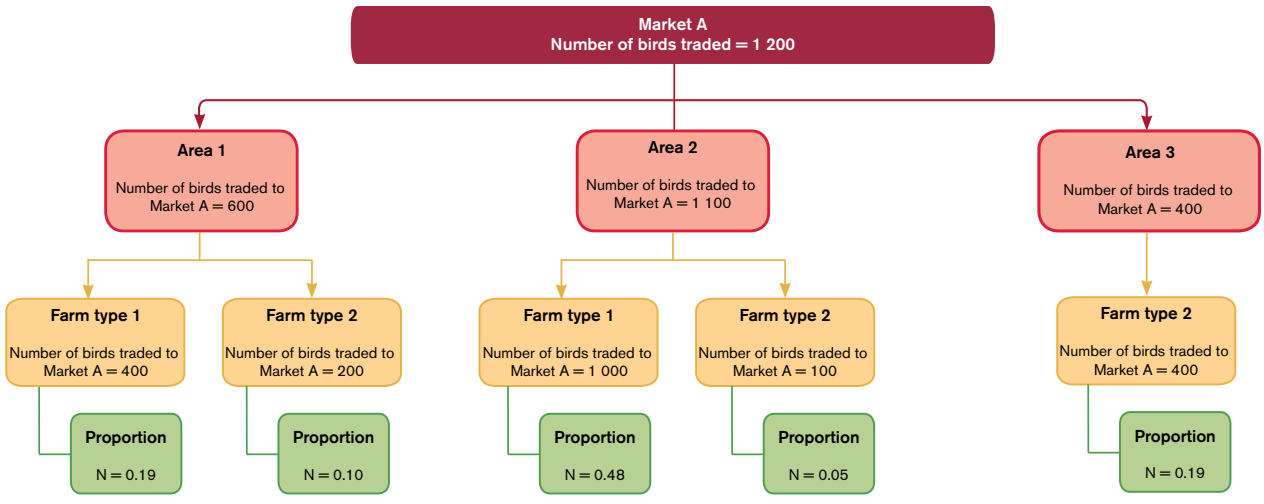
Both environmental and bird sampling should be carried out (see subsection on Sample types in step 1). As the main host reservoir has not yet been identified to date, all the species present at the farm should be included in sample collection, including ornamental/song birds.

Given the short shedding period of the virus, serological testing is the method of choice for detecting potential past

8. This is the number of animals expected to be found positive when randomly sampled from an infected population. It depends on the expected prevalence and the test characteristics.
9. This sample size is calculated for an infinite population size and a confidence limit of 95 percent.

Figure 3: Sampling of farms under a stratified sampling strategy

The numbers of farms that have to be sampled in each area and in each farm type within each area are proportional to the number of birds originating from each farm type and each area. N refers to the proportion of sampled farms that should be selected within each area and farm type.



H7N9 exposure. Blood samples should therefore be taken when possible.

Pooling of samples for virological detection in batches of five swabs is acceptable. The swabs in a pool should all be of the same sample type, species and epidemiologic unit.

The expected virus detection rate is assumed to be lower than 10 percent, meaning that at least 30 birds should be sampled.[10]

A farm is considered positive if at least one sample or pool of samples – environmental, oropharyngeal or cloacal – is found positive by PCR and/or virus isolation. A farm is also considered positive if at least one positive H7 HI case is found and confirmed by an NA-N9 positive test (recommendations for laboratory testing are provided by OFFLU).[11]

Step 3: Investigating markets and farms in contact with positive farms

This step determines the presence of the virus beyond the catchment areas of the selected markets. Farms and markets should be selected for sampling based on the questionnaire survey undertaken in step 2. The environment and birds at these premises will be sampled as described in the previous steps.

Positive farms can also be used for other surveillance objectives, such as zonal serological surveys around positive farms. Complementary to a risk-based surveillance programme, such surveys aim to assess the prevalence of infection in various production systems, identify associated risk factors and achieve other objectives.

2.2. Surveillance at high-risk entry points of live birds and poultry products

The objective of this surveillance strategy is the early detection of virus incursion in an area or country assumed to be uninfected.

Surveillance activities should target the main points of entry of live birds and bird products into an area or country, such as LBMs with high levels of imports from infected areas/countries. Ideally, these control points should be identified through surveys assessing the routes and volumes of imports. If such information is not available, or a rapid survey cannot be conducted, selection can be guided by discussions with local authorities.

LBMs that serve as points of entry should be sampled as described in step 1 in the previous subsection. At border control points, live bird shipments should be sampled, and environmental samples collected from vehicles and cages transporting live birds and bird products.

2.3. Surveillance of migratory bird populations

According to the information currently available, virus introduction into uninfected areas or countries through migratory wild birds cannot be excluded. Potential virus dispersal through bird migration involves migrating patterns and directions (generally north to south or south to north, depending on the season and potential resting sites in an infected area or country – currently eastern China). It is well known that wild birds are reservoirs of many LPAI viruses. With no information available to date regarding the reservoir species of avian influenza A(H7N9) virus, wild bird species that are major natural reservoirs of LPAI viruses (waterfowl and shorebirds) should be considered as having greater potential for virus dispersal, but no bird species (including terrestrial birds) can currently be excluded.

However, the low detection rate of avian influenza viruses in randomly selected wild birds, and the logistics constraints to capturing and sampling wild birds suggest that emergency surveillance programmes should be limited to wild bird congregation sites close to poultry farms in areas/countries at moderate risk located along the migration flyways from infected areas/countries. In addition, the laboratory testing of wild bird samples in ongoing H5N1 HPAI research activities should include testing for H7N9.

2.4. Surveillance of pigs and other non-avian species

Pigs are susceptible to influenza A viruses, and have been shown to be regularly infected by various subtypes of avian origin, including H3, H4, H5, H6 and H9. To date, H7N9 has not been reported in swine. The only case of H7 infection in swine was reported in 2001 in the Republic of Korea. It was caused by an avian-origin influenza A H7N2 virus. Long-term serological surveillance of pigs in China has shown zero sero-prevalence for H7 subtype, from 1 440 sera tested over ten years across the country (Liu *et al.*, 2011). Given this historically low susceptibility to H7, surveillance in pigs should not be considered a priority, as it could distract from more important surveillance efforts in birds. Nevertheless, pigs in contact with infected poultry farms could be tested to improve understanding of the H7N9 epidemiology. Ongoing research activities on swine influenza might enlarge the panel of subtypes tested in pig samples, to create a fuller picture of the pigs' role in the ecology of influenza viruses. Ideally, other mammals susceptible to influenza viruses, especially those that have been in contact with infected birds/farms, should be included in the sampling.

2.5. Retrospective surveillance

Screening of historical samples from domestic poultry

As part of surveillance, it is suggested that historical samples collected from poultry for H5N1 avian influenza surveillance in various countries since November 2012 may be tested for the presence of avian influenza A(H7N9) virus (with priority for oropharyngeal swabs) or anti-H7N9 antibodies (in the case of serum samples). The selection of samples to be tested depends on their source.

Priority should be given to:

- bird samples collected in areas bordering those infected with avian influenza A(H7N9) virus, or linked to an infected area through the live bird movement network;
- bird samples collected from poultry imported from areas currently infected with avian influenza A(H7N9) virus;
- bird samples collected from LBMs known to be central in the live bird trade network.

The testing of historical samples is most informative when the samples come from different farming systems and poultry species.

Laboratory testing

Environmental, oropharyngeal and cloacal swabs should be analysed through M-gene, followed by H7 and N9 reverse transcriptase PCR testing.

Protocols are available on the OFFLU Web site.[12] Sera can be screened with any available H7 antigen, as the H7N9 virus shows good cross-reactivity with various Eurasian H7 antigens previously tested (OFFLU).

If sera from regular (weekly or twice monthly) collection are available, longitudinal multi-subtype serological screening should be conducted to characterize any increase in the sero-prevalence of H7 relative to that of other avian influenza A virus subtypes.

10. This sample size is calculated for an infinite population size and a confidence limit of 95 percent.
11. www.offlu.net
12. www.offlu.net

Priority should be given to H7 and H5 subtypes. Subtypes H9 and H6 (in ducks only) will be helpful in obtaining a more complete picture of the relative spread of each subtype. This screening should be conducted through HI-tests. Such analysis may inform the selection of cloacal and/or oropharyngeal samples for testing.

3. ADDITIONAL MONITORING AND SURVEILLANCE ACTIVITIES

3.1 The live bird trade network

Understanding the live bird trade network is an important prerequisite for improving preparedness for the incursion of a new avian influenza virus. Surveillance of the live bird trade network is recommended for uninfected areas, particularly those at high or moderate risk of incursion.

Ideally, surveys of the movements of commercial live birds and traders should be conducted to gather information about networks. If information about LBMs and farms in the area of concern is lacking, a snowball sampling strategy is recommended (Wasserman and Faust, 1994). In this strategy, units to be sampled (e.g., farms or markets) are identified according to their connections to other units (e.g., via commercial movements of live birds). For example, for H7N9 surveillance, a first set of markets are identified and visited, then the markets and farms linked to this first set through the movement of live birds and/or traders are identified and surveyed. This process is repeated several times, to map the wider network of live bird trade and traders' movements.

Questionnaire surveys for collecting such information may be prone to recall bias, so direct observations should be made to assess the reliability of the questionnaire results. Live bird trade networks can then be described using social network analysis.

This methodology provides a mathematical characterization of the relationships among entities – in this case markets and farms – in the network of interest (Wasserman and Faust, 1994). It also enables identification of the highly connected markets or other premises in the network, which are those most likely to become infected. The survey should capture the trader practices that influence the length of time birds spend in the market chain, which will allow identification of the markets and associated structures (such as collection yards) that are most likely to act as viral reservoirs in the network.

Such an approach will indicate where an incursion of the virus is most likely to be detected rapidly.

3.2 Monitoring of production variables on commercial farms

Early warning systems (EWS) are based on the monitoring of selected health and non-health variables for the early detection of any abnormal variation that may be linked to a disease event (syndromic surveillance). Good recording systems (with daily recording if possible) and long-term time-series data are required to define a baseline and detect significant changes. Although not specific to avian influenza, such EWS should be developed, especially in industrial production systems.

The feasibility of EWS has already been demonstrated using data from the 2002 to 2006 H6N2 LPAI epidemic in the industrial production systems of the United States of America (California) (Beltrán-Alcrudo, Carpenter and Cardona, 2009). For LPAI, clinical signs may be inapparent, very mild or non-specific at the individual animal level. Subtle changes in production variables at the population level – such as daily mortality, egg production, or feed and water intake – are sometimes the only means of clinical detection of the presence of an infection (Spickler, Trampel and Roth, 2008). In an EWS, when a recommended trigger point, such as a certain level of mortality, is reached or exceeded, an alert is activated, which should be followed by actions such as reporting to the veterinary services or stopping the movement of birds.

The EWS should be combined with prompt laboratory diagnosis that allows the rapid implementation of control actions, such as isolation or sanitation. The potential benefit of early detection of an outbreak should be balanced with the probability and costs of a false alert. A highly sensitive EWS will detect an outbreak very quickly, but at the cost of having a high number of false alerts; a less sensitive EWS will reduce the number of

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false alerts, but will detect an outbreak later and be more likely to miss it. To avoid any unnecessary delay in diagnosis, the system should be based on daily observations (rather than weekly ones). While an EWS is an inexpensive tool for the early detection of low pathogenic viruses, it takes time to establish the trigger points for a particular pathogen in different production systems (Beltrán-Alcrudo, Carpenter and Cardona, 2009)

4. RECOMMENDATIONS FOR SURVEILLANCE AT THE HUMAN–ANIMAL INTERFACE

Surveillance at the human–animal interface aims to identify the sources of human exposure, and thus to decrease the risk of human infection. Intervention approaches can be based on joint animal and public health outbreak investigations and exploration of the direct contacts between infected humans and infected birds, and exposure to contaminated environments.

Outbreak investigation protocols for infected areas should include sample collection from the environment. LBMs with low biosecurity levels increase the likelihood of direct contact with animals, and also allow virus circulation to amplify and be sustained.

In the area of interest, market selection should be based on the presence of practices that increase the time live birds spend in the market, and of characteristics that promote disease transmission (by increasing contacts among birds and/or virus survival in the environment). From previous studies with H5N1AI, human risk appears to be correlated with a high prevalence of contaminated market environments (e.g., in Indonesia). More details on environmental surveillance in LBMs can be found in Horm *et al.* (2013) and Indriani *et al.* (2010).

The potential role of ornamental birds in the transmission of infection to humans may warrant surveillance where there is extensive trade in such birds and they are present in large numbers of households. Such surveillance will establish whether ornamental birds are likely to be a significant risk factor for human cases.

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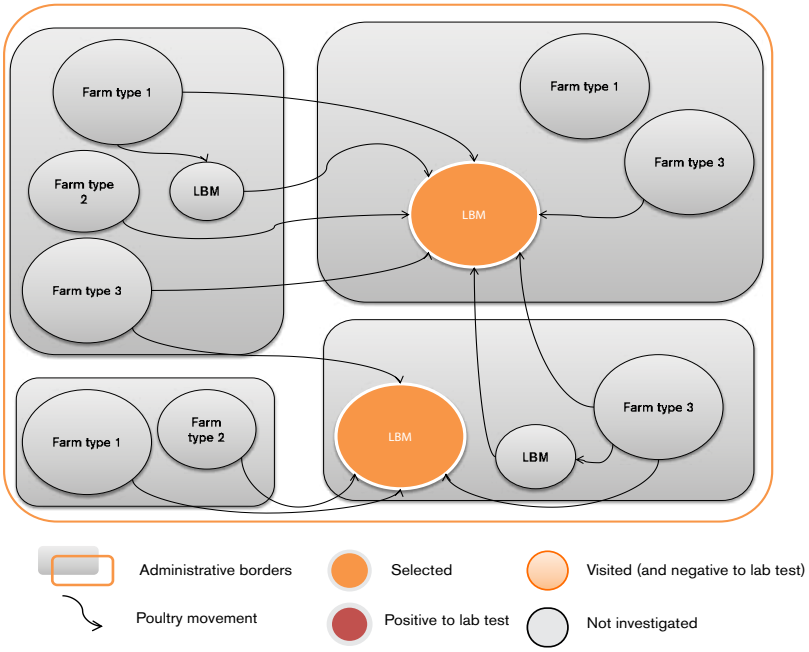
ANNEX 1

Illustration of risk-based surveillance along the market chain

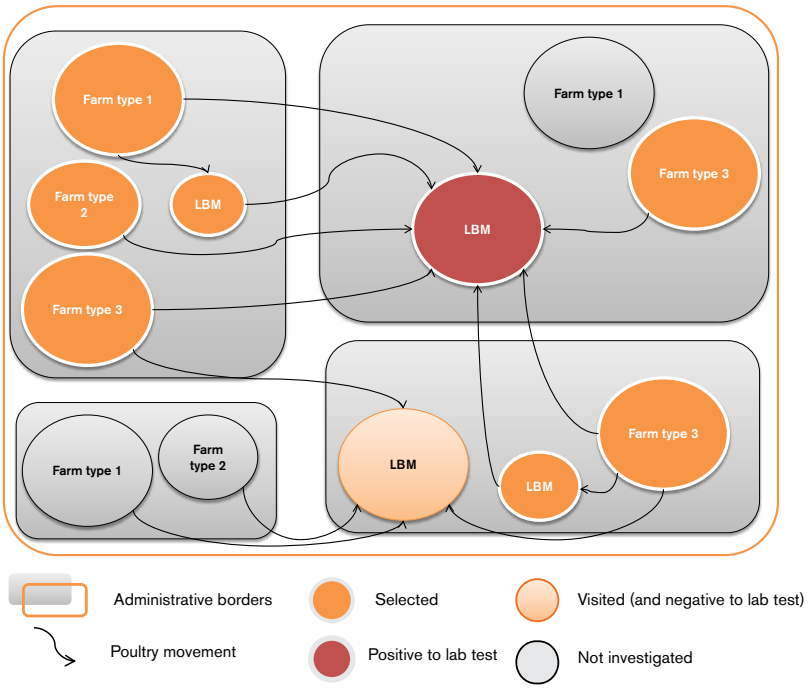
Step 1: Identification of central live bird markets

Example: In a given administrative area, there are four LBMs, but only two fit the selection criteria. The risk-based surveillance protocol will target the LBMs shown in orange. A given farm type does not represent a single farm. It represents all the farms of a given type in a given region.



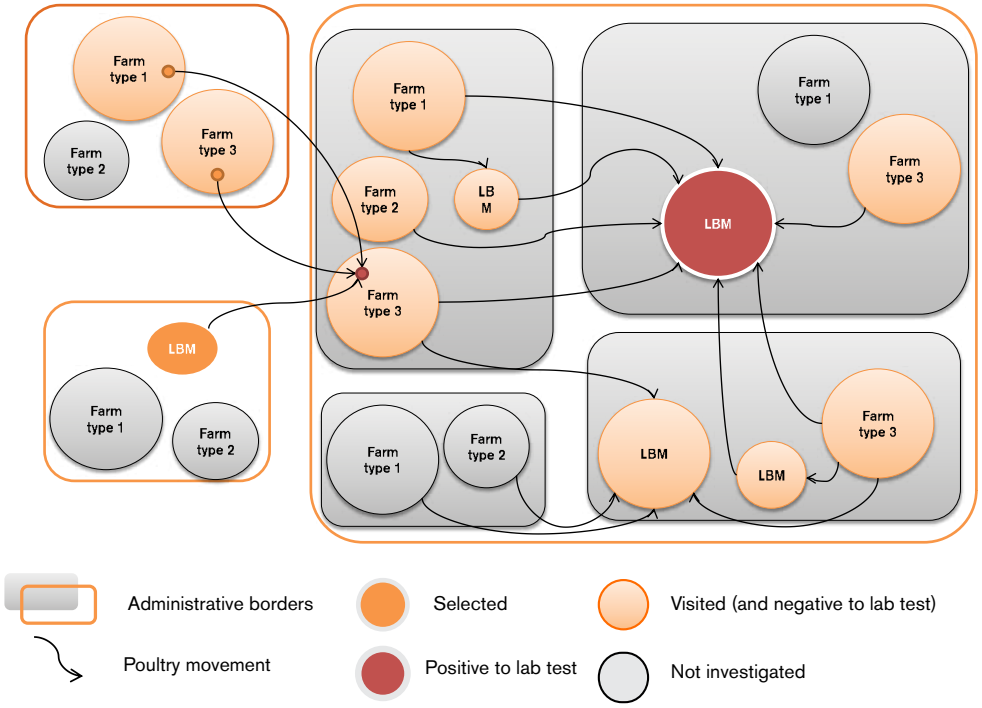
Step 2: Identification of the catchment area of positive LBMs

Example: Of the sampled LBMs, only one LBM was found H7N9-positive (displayed in red). In the catchment area (the geographic area supplying the LBM), other markets and farm types supplying this LBM will be visited for sample collection and the administration of questionnaires. In this example, three regions are included in the catchment area. Within these regions, only farming systems and markets displayed in orange will be visited, as they supply the contaminated LBM with live birds.



Step 3: Catchment area of positive farms/markets

Among the farms and markets visited in step 2, one farm (of type 3) was found to be contaminated (displayed in red). All the farms and markets providing live birds to, or in contact with (e.g., through visits of feed supplier, other farmers, etc.), this farm will be visited, samples will be collected and questionnaires administered. In addition, a serological survey could be conducted in the province or within a defined radius around the farm.



ANNEX 2

Examples of questionnaires for traders at live bird markets

General notes about the questionnaires:

- Farm types need to be defined before the survey is conducted.
- If a trader reports having bought birds from another trader outside the LBM network, and supplies this trader's details, the second trader should be contacted, and asked about the origin of the birds that he/she sells (see Annex 2B).
- A time frame (denoted as [time] in the questionnaires) of a week, ten days, 15 days or a month should be chosen according to traders' ability to recall past transactions. It should be noted that when the market contamination is recent, a short time frame maximizes the likelihood of detecting the source of infection in step 2 of the surveillance strategy. However, if virus circulation can be amplified and sustained in markets, the actual source of infection might be missed with a short time frame.

Annex 2A: Questionnaire for traders operating in a live bird market (step 1)

Date: _____ Interviewer's name: _____ Questionnaire ID: _____

Q1: Of the birds that you have sold in this market within the last *[time]*, were any bought at another live bird market? Yes |_| No |_|

Q1a: *If yes,* please specify the location of these other live bird markets, and how many birds from each species you bought in each market within the last *[time]*
If the trader is uncertain about the exact number, write down a range.

	Market 1	Market 2	Market 3	Market 4	Market 5	Market 6
Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ Other species 2:_____

Q2: Of the birds that you have sold in this market within the last *[time],* were any bought from other traders outside of live bird markets? Yes |_| No |_|

Q2a: *If yes,* please specify the location of the transactions, and how many birds from each species you bought from each trader within the last *[time]*, and the contact details of each trader.
If the trader is uncertain about the exact number, write down a range.

	Trader 1	Trader 2	Trader 3	Trader 4	Trader 5	Trader 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

Contact details

Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____	_____	_____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ Other species 2:_____

Q3: Of the birds that you have sold in this market within the last *[time]*, were any bought from farmers outside of live bird markets? Yes |_| No |_|

Q3a: *If yes,* please specify the location of the farms, the types of farm that you have visited, and how many birds from each species you bought from each farm type, at each location in the last *[time]*.
If the trader is uncertain about the exact number, write down a range. Identification of the supplying farms is not required, only the location (at the lowest possible administrative level) and farm type should be recorded. A separate column of the following table should be filled in for each combination of farm type and location.

	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

	Comb 7	Comb 8	Comb 9	Comb 10	Comb 11	Comb 12
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ Other species 2:_____

Q4: Of the birds that you have sold in this market within the last *[time]*,were some from your own farm? Yes |_| No |_|

Q4a: *If yes,* please specify the location of the farm, its type, and how many birds from each species you sold from your farm within the last *[time]*.

	Your own farm
Admin 1	_____
Admin 2	_____
Admin 3	_____
Admin 4	_____
Farm type	___
|_| CK	____-____
|_| DK	____-____
|_| Mu	____-____
|_| GS	____-____
|_| PI	____-____
|_| oth 1	____-____
|_| oth 2	____-____

Annex 2B: Questionnaire for traders supplying other traders operating in a live bird market

If a trader interviewed at a live bird market has reported buying birds from another trader outside live bird markets, and has provided this trader's details, this second trader should be contacted and asked about the origin of the birds that she/he sells, using the following questionnaire.

Date: _____ Interviewer's name: _____ Questionnaire ID: _____

Q1: Of the birds that you have sold within the last *[time]*, were some bought at a live bird market? Yes |_| No |_|

Q1a: *If yes,* please specify the location of these live bird markets, and how many birds from each species you bought in each market within the last *[time].*

If the trader is uncertain about the exact number, write down a range.

	Market 1	Market 2	Market 3	Market 4	Market 5	Market 6
Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ ; Other species 2:_____

Q2: Of the birds that you have sold within the last *[time]*, were any bought from another trader outside of live bird markets? Yes |_| No |_|

Q2a: *If yes,* please specify the locations of the transactions, and how many birds from each species, you bought from each trader within the last *[time]*, and the contact details of each trader.
If the trader is uncertain about the exact number, write down a range.

	Trader 1	Trader 2	Trader 3	Trader 4	Trader 5	Trader 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

Contact details

Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____	_____	_____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ ; Other species 2:_____

Q3: Of the birds that you have sold within the last *[time]*, were any bought from farmers outside of live bird markets? Yes |_| No |_|

Q3a: *If yes,* please specify the locations of the farms, the types of farm that you have visited, and how many birds from each species you bought from each farm type, within each location, within the last *[time]*.
If the trader is uncertain about the exact number, write down a range. Identification of the supplying farms is not required, only the location (at the lowest possible administrative level) and farm type should be recorded. A separate column of the following table should be filled in for each combination of farm type and location.

	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

	Comb 7	Comb 8	Comb 9	Comb 10	Comb 11	Comb 12
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons;
Other species 1:_____ ; Other species 2:_____

Q4: Of the birds that you have sold within the last *[time]*, were any from your own farm? Yes |_| No |_|

Q4a: *If yes,* please specify the location of the farm, its type, and how many birds from each species were sold from your farm within the last *[time]*.

	Your own farm
Admin 1	_____
Admin 2	_____
Admin 3	_____
Admin 4	_____
Farm type	___
|_| CK	____-____
|_| DK	____-____
|_| Mu	____-____
|_| GS	____-____
|_| PI	____-____
|_| oth 1	____-____
|_| oth 2	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ ; Other species 2:_____

ANNEX 3

Examples of questionnaires for farmers and their contacts (step 2)

Notes about the questionnaires:

- These questionnaires aim to identify the potential sources of infection of farms found to be positive. They are similar to the questionnaires used in an outbreak investigation, which may therefore also be used for this purpose.
- The following questionnaires provide templates that need to be adapted to the characteristics of each production system investigated.
- The choice of time frame (denoted as [time] in the questionnaires) will depend on how long an epizootic has been present at a farm. This will be influenced by the characteristics of the virus, the host and the farming system. In the absence of information, a time frame of one month can be used.
- Traders (operating in or outside live bird markets) and other farmers supplying a positive farm should be interviewed using the respective questionnaires (Annexes 2A, 2B and 3A). Production stakeholders found to be in contact with a positive farm should be interviewed with the questionnaire in Annex 3B

Annex 3A: Questionnaire for farmers

Date: _____ Interviewer's name: _____ Questionnaire ID: _____

Q1: Of the birds that you have introduced into your farm within the last *[time]*, were any bought at a live bird market? Yes |_| No |_|

Q1a: *If yes,* please specify the location of the live bird market(s), and how many birds from each species you bought at each market within the last *[time]*.

If the farmer in uncertain about the exact number, write down a range.

	Market 1	Market 2	Market 3	Market 4	Market 5	Market 6
Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons;
Other species 1:_____ ; Other species 2:_____

Q2: Of the birds that you have introduced into your farm within the last *[time]*, were any bought from traders outside live bird markets? Yes |_| No |_|

Q2a: *If yes,* please specify the location of each transaction, and how many birds from each species, you bought from each trader within the last *[time]*, and the contact details of each trader.

If the farmer is uncertain about the exact number, write down a range.

	Trader 1	Trader 2	Trader 3	Trader 4	Trader 5	Trader 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

Contact details

Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____	_____	_____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons;
Other species 1:_____ ; Other species 2:_____

Q3: Of the birds that you have introduced into your farm within the last *[time]*, were any bought from farmers outside of live bird markets? Yes |_| No |_|

Q3a: *If yes,* please specify the location and type of each farm that you have visited, and how many birds from each species you bought from each farm type within each location, within the last *[time]*.

If the farmer is uncertain about the exact number, write down a range. Identification of the supplying farms is not required, only the location (at the lowest possible administrative level) and farm type should be recorded. A different column of the following table should be filled in for each combination of farm type and location.

	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

	Comb 7	Comb 8	Comb 9	Comb 10	Comb 11	Comb 12
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons;
Other species 1:_____ ; Other species 2:_____

Q4: Please list all the stakeholders in the poultry production system who have visited your farm within the last *[time]* (excluding contacts with the people visiting the farm to conduct the transactions mentioned in question 2), and the contact details of each.

	1	2	3	4
Veterinarian	|_|	|_|	|_|	|_|
Feed supplier	|_|	|_|	|_|	|_|
Farmer	|_|	|_|	|_|	|_|
Trader (purchase)	|_|	|_|	|_|	|_|
Egg collector	|_|	|_|	|_|	|_|
Slaughterhouse (collector)	|_|	|_|	|_|	|_|
Name	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____

	1	2	3	4
Veterinarian	|_|	|_|	|_|	|_|
Feed supplier	|_|	|_|	|_|	|_|
Farmer	|_|	|_|	|_|	|_|
Trader (purchase)	|_|	|_|	|_|	|_|
Egg collector	|_|	|_|	|_|	|_|
Slaughterhouse (collector)	|_|	|_|	|_|	|_|
Name	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____

Annex 3B: Questionnaire for stakeholders in contact with a positive farm

Date: _____ Interviewer's name: _____ Questionnaire ID: _____

Q1: Please list all the live bird markets that you have visited in the last *[time].*

	Market 1	Market 2	Market 3	Market 4	Market 5	Market 6
Name	_____	_____	_____	_____	_____	_____
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____

Q2: Please list all the farms that you have visited in the last *[time],* and the contact details of each. If you cannot identify each farm exactly, please specify the location, at the lowest possible administrative level, and farm type.

	Comb 1	Comb 2	Comb 3	Comb 4	Comb 5	Comb 6
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Name	_____	_____	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

	Comb 7	Comb 8	Comb 9	Comb 10	Comb 11	Comb 12
Admin 1	_____	_____	_____	_____	_____	_____
Admin 2	_____	_____	_____	_____	_____	_____
Admin 3	_____	_____	_____	_____	_____	_____
Admin 4	_____	_____	_____	_____	_____	_____
Name	_____	_____	_____	_____	_____	_____
Phone no.	_____	_____	_____	_____	_____	_____
Farm type	___	___	___	___	___	___
|_| CK	____-____	____-____	____-____	____-____	____-____	____-____
|_| DK	____-____	____-____	____-____	____-____	____-____	____-____
|_| Mu	____-____	____-____	____-____	____-____	____-____	____-____
|_| GS	____-____	____-____	____-____	____-____	____-____	____-____
|_| PI	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 1	____-____	____-____	____-____	____-____	____-____	____-____
|_| oth 2	____-____	____-____	____-____	____-____	____-____	____-____

CK: chickens; DK: ducks (mallard-derived breed); Mu: Muscovy ducks; GS: geese; PI: pigeons; Other species 1:_____ ; Other species 2:_____

ANNEX 4

Minimum information to collect for each biological sample

Information on the sample collection site

- Identification code of site
- Location type: live bird market or farm
- Location: latitude and longitude
- Date
- Production type: layer, broiler, dual-purpose, breeder, local village poultry
- H5 and H7 vaccination status
- Total number of samples collected, by type and by species
- Total number of animals present on the day of the visit

Information on the sample

- Identification code of sample
- Identification of seller/farm
- Date of collection
- Type of sample
  - cloacal swab
  - oropharyngeal swab
  - environmental swab (precise)
  - blood
- Species: chicken, duck, quail, pigeon, wild bird, other
- Age (in weeks)
- Clinical signs

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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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These guidelines are based on the information available to date and will be reviewed as new information becomes available.

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