

Avian Influenza Training

Facilitator Guide

Table of Contents

Module 1	
Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans.....	7
Presentation Handouts	9
Exercises	25
Background Information	41
Module 2	
Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry	
Outbreak.....	75
Presentation Handouts	77
Exercises	93
Part 1: Background information on clinical features and case management of suspected	
avian influenza H5N1 infection	95
Part 2: Public Health Action	104
Background Information	113
Module 3	
Infection Control and Personal Protective Equipment.....	155
Presentation Handouts	157
Exercises	171
Part 1: Group Discussion/Brainstorming Activity– Accessing and Prioritizing PPE	
during an Avian Influenza Pandemic.....	173
Part 2: Group Discussion and Problem Solving Activity– Applying Infection Control	
Measures to Different Situations	175
Background Information	179
Module 4	
Investigation of Poultry on a Farm	235
Presentation Handouts	237
Exercises	259
Module 5	
Case Management of Suspect Human Avian Influenza H5N1 Infection	267
Exercises	267
Appendix A Case Management: WHO Avian Influenza Case definitions as of August	
29, 2006.....	282
Appendix B Case Management: Template for case report form	284
Module 6	
Laboratory Diagnostics.....	297
Presentation Handouts	299
Exercises	319
Part 1: The Sampling Time Frame for a Suspect Avian Influenza Case	322

Part 2: Prioritizing which laboratory tests to perform	325
Part 3: Analysis of laboratory data.....	327
Part 4: Interpretation of laboratory test results	329
Background Information.....	333
Case Study	
Case Investigation of Suspected Human Infection with Avian Influenza A	371
A. Preparation	376
B. Possible Poultry Outbreak: Part 1	380
B. Possible Poultry Outbreak: Part 2	382
C. Planning Response - Logistics	385
D. Planning Response - Communications	387
E. Initial Response	391
F. Investigation – Interviewing Possible Cases	394
G. Investigation – Quarantine, Antivirals, and Vaccine	397
H. Investigation – Active Surveillance	401
I. Investigation – Case Classification.....	404
J. Investigation – Case Interviewing.....	408
K. Investigation – Case Management and Communication.....	410
L. Investigation – Infection Control.....	412
M. Investigation – Case Classification and Line Listing.....	415
N. Investigation – Specimen Collection	421
O. Investigation – Assessing Human-to-Human Transmission.....	424
P. Investigation – Daily Report.....	426
Q. Investigation – Epi Curve	431
R. Investigation – Mass Antiviral Chemoprophylaxis.....	434
S. Investigation – Risk Communication	438
T. Conclusion.....	440
U. Evaluation	441
Appendix A Case Study: Generic Outbreak Reporting Questionnaire.....	443

Module 1

Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans

Presentation Handouts

Exercises

Background Information

Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans

Presentation Handouts

Surveillance for Avian Influenza among Humans and Animals



Welcome to the Rapid Response Training: The Role of Public Health in a Multi-Agency Response to Avian Influenza in the United States. This training will be executed primarily in smaller group breakout sessions, where you will work on case studies and table top exercises. This presentation offers a brief introduction to the first session: Surveillance for Avian Influenza among Humans and Animals.

Presentation Overview

- Federal Agencies
- Animal Influenza Surveillance
 - Poultry
 - Wild Birds
- Human Influenza Surveillance
 - Routine
 - Enhanced

In a nutshell, this presentation will cover federal agencies involved in surveillance, and some of the specifics about surveillance among birds and humans.

Federal Agencies

- US Department of Health and Human Services (DHHS)
 - CDC
- US Department of Agriculture (USDA)
- US Department of the Interior (DOI)

There are three federal agencies involved in influenza surveillance for poultry, wild birds, and humans, respectively. They are the US Department of Health and Human Services (DHHS), including the Centers for Disease Control (CDC), the US Department of Agriculture (USDA), and the US Department of the Interior (DOI). The activities of each of these agencies are detailed further in the background information provided in your materials.



**Influenza
Surveillance
Among
Humans**

First, we will present information on influenza surveillance among humans.

Routine National Surveillance

1. Virologic - laboratory reporting
2. Sentinel Providers Network
3. State and territorial epidemiologists reports
4. Emerging Infections Program
5. New Vaccine Surveillance Network
6. 122 Cities Mortality Reporting System
7. Influenza-associated pediatric mortality

There are 7 components to routine influenza surveillance conducted by the CDC. The first, laboratory reporting by WHO and National Respiratory and Enteric Virus Surveillance System (NREVSS) collaborating labs, is virologic surveillance. In other words, this component relies on positive identification of an influenza virus by a laboratory. The other 6 components to the surveillance system are disease-based, relying on a clinical diagnosis of influenza.

1. The second component is the Sentinel Providers Network. This is a network of approximately 1,200 healthcare providers nationally that report influenza-like illness (ILI) during flu season.
2. The third component is based on State-level surveillance. State and territorial epidemiologists report the level of influenza activity in their state (no activity, sporadic, local, regional, or widespread).
3. The fourth component is the Emerging Infections Program. This program tracks laboratory-confirmed influenza-related hospitalizations for 12 metropolitan areas in 10 states.
4. The fifth component is the New Vaccine Surveillance Network, which tracks laboratory-confirmed influenza-related hospitalizations for children under 5 in 3 US counties.
5. The sixth component is 122 Cities Mortality Reporting System. This system tallies the vital statistics from 122 cities that report deaths due to pneumonia and influenza (P&I).
6. The last component is Influenza-associated pediatric mortality –these are deaths related to influenza for children under 18, which is a nationally notifiable condition.

Human Surveillance

Upon confirmed HPAI in animal species...

1. Conduct active case finding
2. Assess exposures
3. Classify and test potential cases
 - Suggested guideline:
 - CDC case definitions for detection
 - WHO case definitions for reporting

The biggest change from routine surveillance to enhanced surveillance (upon HPAI in animals) is to conduct active case finding activities, which is more resource-intensive than relying on existing passive surveillance systems.

The three primary surveillance activities, once HPAI has been confirmed in animals, are: 1) active case finding, 2) exposure assessment, and 3) case classification and testing. The background slides in your resource notebook address each of these major surveillance activities, and then specific actions that should be taken to complete these activities. It is suggested that you use established case definitions to help classify any cases. Case definitions developed by CDC can be used for detecting cases and determining whether individuals should be tested. Case definitions developed by WHO can be used for reporting purposes, particularly international reporting.

Enhancing Local Surveillance

- Enhance surveillance and record review in hospitals
- Public Service Announcements
- Telephone hotlines
- Door-to-door surveys
- Occupational surveillance

On a practical level, enhancing surveillance for cases meeting these criteria can be accomplished through several different methods. Hospitals will be a primary source for detecting severe respiratory illnesses. Emergency department records and discharge data are two ways of specifically looking for cases in hospitals.

Public service announcements, carefully designed to have a clear and simple message, can alert the general public to see their doctor if they have specific symptoms and/or exposures. Alternatively, you may want to publicize a telephone hotline, where the public can ask questions and also report suspect cases.

Door-to-door surveys in a locally-defined area where cases are most likely can also turn up cases and/or people at high risk of exposure.

Finally, surveillance among high risk occupations such as poultry workers and healthcare workers is clearly a way to keep track of symptoms that may develop among those with potential exposures.

Poultry Outbreak and Human Surveillance Activities

- Limit case definition
- Disseminate case definition
 - Health Alert Network (HAN)
 - Epi-X
- Create and disseminate outbreak reporting questionnaire
- Consider database and reporting tools
- Identify and interview potential cases and contacts

In the event of an outbreak of HPAI among poultry, human surveillance activities should include the following actions:

- Limit the case definitions just listed to specific situations, including specific symptoms, the incubation period, defined exposures, and laboratory test results.
- Disseminate the outbreak case definition to outbreak investigators and others that might be involved in case detection (such as local physicians or hospitals). This can be done at the local level through the Health Alert Network, or through CDC's secure web-based system, Epi-X.
- Create and disseminate an initial outbreak reporting questionnaire to outbreak investigators.
- Consider database and reporting tools that will be used to store and summarize the collected data as well as assist with case and information management.
- Identify potential cases and contacts and administer the outbreak-reporting questionnaire. Further follow-up and communication will then be required for all individuals identified as potential case-patients and their contacts.

Surveillance Activities cont.

- Conduct surveillance for human illness linked to affected premises
- Ensure timely reporting of cases to CDC
- Characterize seasonal influenza strains
- Notify other states that might receive cases or contacts
- Advise contacts to monitor symptoms for 10 days post-exposure

- Conduct ongoing surveillance for human illness linked to affected premises.
- Ensure timely reporting of any suspect, probable, or confirmed human cases and reporting of control measures put in place, through the normal reporting channels (i.e., from local public health to state authority to CDC). This information dictates which pandemic phase the country is in, so it will also be shared with WHO.
- If the outbreak occurs during flu season, characterize human seasonal influenza strains currently circulating in or near the affected area(s) to differentiate avian and seasonal influenza.
- Notify any other states that might be receiving cases or contacts linked to the outbreak (e.g., workers involved in poultry control and eradication activities and who are returning to their home state). This notification should occur directly between states to avoid delays and should include (as permitted by state legislation) the individual's name and contact information as well as the status of the individual with respect to their clinical illness and any required ongoing treatment and monitoring. Similarly, if contacts are being actively managed (e.g., daily active surveillance) as part of the outbreak response, these individuals should be referred to their respective state if the monitoring period has not been completed by the time the individual is leaving the outbreak state.
- Advise contacts that if they must leave the affected site, they should be aware of the possibility of symptom development up to 10 days after last exposure. Should symptoms develop, they should be instructed to both see a physician and report their symptoms and possible exposure to a local public health authority. Although this may be part of surveillance activities investigators should consider specialized data or laboratory specimen collection requirement and human subjects authorizations needed to facilitate near-term research studies to build the knowledge base for detection, prevention, and control of avian influenza in humans (e.g., laboratory testing for evidence of asymptomatic infection).

Possible Contacts

- Poultry workers
- Agriculture responders
- Farmers
- Veterinarians
- People purchasing poultry products
- Farm visitors
- Travelers

When conducting active case finding and contact tracing, here are some groups you should consider interviewing, because they may have direct contact with poultry: poultry workers, agriculture responders, farmers, veterinarians, people purchasing poultry products, farm visitors, and travelers.

Possible Contacts

Also:

- Healthcare workers
- Family members and other close contacts
- Emergency Medical Services staff

Additional groups that may be at risk include hospital workers family members or other close contacts of suspected or confirmed cases, and Emergency Medical Services staff. These groups will be at especially high risk if human-to-human transmission is suspected or confirmed.

Local Surveillance During Pandemic Alert

Continue routine surveillance activities AND

- Investigate clusters of influenza-like illness with a) recent travel to area with documented novel or avian flu, or b) severe morbidity and mortality
- Facilitate viral testing for persons with ILI and epidemiologic risk factors

During a pandemic alert, when there is increased concern about the transmission of a highly pathogenic avian influenza virus among humans, local surveillance will also include ongoing routine surveillance activities and investigation of clusters of influenza-like illness associated with recent travel to an area with documented novel or avian flu, or clusters of ILI that are associated with severe morbidity and mortality. During this phase, local health departments may also facilitate viral testing for persons with ILI and epidemiologic risk factors.

Goals of Human Surveillance for Pandemic Influenza

- Virologic Surveillance
 - Detect initial cases of pandemic strain
 - Track introduction of virus to local areas
 - Monitor changes in virus
- Disease-based Surveillance
 - Early warning of increased ILI
 - Monitor health effects of pandemic
 - Track trends in disease activity

As stated in the HHS Pandemic Influenza Plan, the primary goals for influenza surveillance during a pandemic are:

For surveillance of viruses (virologic surveillance):

- rapidly detect initial cases of pandemic strain,
- track the introduction of the virus into local areas, and
- monitor changes in the virus, including antiviral resistance.

For surveillance of influenza-associated illness and death (disease surveillance):

- serve as early warning for increase in influenza-like illness in the community,
- monitor the effect of the pandemic on health, and
- track trends in disease activity and identify most severely affected populations.

The last goal of disease-based surveillance will be important in deciding which control measures to implement, and which groups should receive high priority for vaccine and antiviral use.



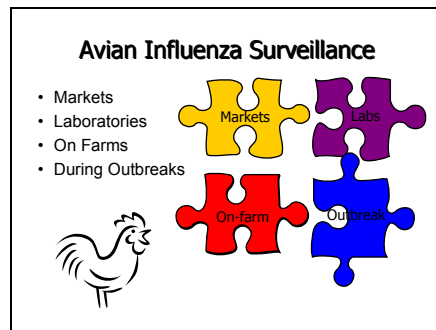
Influenza Surveillance Among Animals

AI Surveillance

- Active and passive surveillance currently conducted by various means:
 - NPIP testing of commercial poultry
 - Live bird market system testing
 - Testing prior to export of poultry products
 - State active surveillance programs
 - Diagnostic laboratory evaluation of ill birds
 - Foreign animal disease diagnostician (FAD) investigations of suspect FADs
 - Wild bird surveillance

National surveillance for AI is accomplished through several means:

- the National Poultry Improvement Plan (NPIP) has a program for breeder flocks (in place since 1998);
- States conduct surveillance in areas where AI has historically been a concern (e.g., live bird marketing system);
- industry working with states conduct export testing at slaughter;
- State and university laboratories test suspect cases; and
- Wild bird surveillance



In general, AI surveillance in poultry occurs primarily in four ways, through markets, laboratories, on-farms and during outbreaks of AI.

 **Notifiable Avian Influenza (NAI)**

"Avian influenza in its notifiable form (NAI) is defined as an infection of poultry **caused by any influenza A virus of the H5 or H7 subtypes or by any AI virus with an intravenous pathogenicity index (IVPI) greater than 1.2 (or as an alternative at least 75% mortality) as described...** NAI viruses can be divided into highly pathogenic notifiable avian influenza (HPNAI) and low pathogenicity notifiable avian influenza (LPNAI)"

In accordance with changes in 2006 to the World Organization for Animal Health (OIE) Code, all confirmed detections of H5 and H7 AI must be reported to State and Federal officials and to the OIE. This includes LPAI H5 and H7 subtypes because of their potential to mutate into highly pathogenic strains.

Therefore, USDA now tracks these detections in wild birds, backyard flocks, commercial flocks, and live bird markets.

Commercial Flocks

National Poultry Improvement Plan (NPIP)

- USDA program
- Monitor poultry production facilities
- Random testing of flocks
 - Test all ill birds
- Coordinate with states for response and containment plans

An example of on-farm surveillance is the National Poultry Improvement Plan (NPIP), which administers the surveillance program in commercial poultry. This includes the monitoring of poultry production facilities and random testing of poultry flocks with tests performed on all birds that appear ill. As part of the program, USDA has worked with states to develop state response and containment plans.

Wildlife Surveillance

Five components to surveillance

- 1) Investigation of morbidity and mortality
- 2) Surveillance in live wild birds
- 3) Surveillance in hunter-killed birds
- 4) Sentinel species monitoring
- 5) Environmental sampling

Surveillance among wildlife also occurs. One of the primary activities of the DOI is the testing of migratory birds for HPAI, with priority placed on birds in Alaska and the Pacific flyway, since those birds have a higher likelihood than others of mixing with birds from the East Asian and East Asian-Australasian flyways. The DOI has 5 primary strategies for surveillance. They are:

- Investigation of morbidity and mortality in wild birds
- Surveillance in live wild birds (focus on species with highest risk of exposure to or infection with H5N1 or other HPAI)
- Surveillance in hunter-killed birds (sampling occurs at hunter check-stations)
- Sentinel species monitoring (disease-free waterfowl, exhibition gamefowl, and backyard poultry flocks are used as sentinel species)
- Environmental sampling (both water and fecal material from waterfowl habitat)

Reporting HPAI in Poultry

- Reporting varies by state
 - Industry
 - Backyard flocks
 - H5 or H7 LPAI
- Presumptive positive cases reported to USDA or DOI will be immediately reported to:
 - OIE
 - Trade partners
 - Other Federal agencies
 - States
 - Industry

Participation in USDA sponsored testing and reporting programs for avian influenza is voluntary for the states. States may require or request reporting of clinical symptoms and/or laboratory test results for both industry and backyard bird owners. The USDA works closely with the poultry industry in 21 states to facilitate reporting and containment of avian influenza among poultry flocks, and the other states have their own monitoring programs in place. The USDA is also monitoring H5 and H7 strains of low-pathogenic avian influenza.

Presumptive positive cases reported to the USDA or to Department of Interior agencies will be immediately reported to the OIE, trade partners, other Federal agencies, the State, and industry. This may include cases in breeder and commercial poultry flocks, domestic waterfowl and upland game birds, backyard flocks, live birds markets, and wild birds. Response measures would be initiated prior to receipt of confirmatory results from NVSL.

Response in the Event of an HPAI Outbreak

- Response actions for domestic flocks:

- Surveillance
- Quarantine and humane euthanasia
- Cleaning and disinfection of premises
- Possible use of vaccine in poultry
- Indemnity payments
- Communication to media and the public



The final surveillance stream only occurs in the event of an outbreak. Surveillance activities are conducted in a zone around the affected premises, as well as hierarchical buffer zones around the affected zone.

Response actions that are taken for domestic flocks include:

- Surveillance for HPAI
- Quarantine and humane euthanasia upon detection of HPAI
- Cleaning and disinfection of premises
- Possible use of vaccine in poultry
- Indemnity payments, and
- Communication to media and the public

Responding to Influenza among Poultry

- LPAI outbreak
 - Affected State takes the lead
 - Clean, disinfect, depopulate affected premises
 - USDA provides funding
 - Close attention to H5 and H7 strains
- HPAI outbreak
 - USDA takes the lead
 - Quarantine, clean, disinfect, and cull the infected and exposed bird population
 - CDC is notified
 - Bird owners compensated

The response will vary depending on the type of avian influenza detected. If low pathogenic avian influenza (LPAI) is detected, USDA works with the affected state, which takes the lead. A series of measures are undertaken to clean, disinfect, and depopulate the affected premises in order to quickly contain and eradicate the disease. USDA provides funding and support personnel to states when LPAI is detected. Close attention is paid to H5 and H7 LPAI strains, because of their potential to mutate into HPAI.

If HPAI is detected, USDA is the lead and will work with the affected State Department of Agriculture and the affected premises to quarantine, clean, disinfect, and cull the infected and exposed bird population in order to quickly contain and eradicate the disease. When HPAI is detected, personnel from USDA's Animal and Plant Health Inspection Service (APHIS) are primary responders to control the virus because of the disease infectivity and high mortality rate among poultry. As part of the response, USDA will notify the U.S. Department of Health and Human Services' Centers for Disease Control. Additionally, USDA works with the affected premises to compensate owners for the loss of culled birds due to the disease outbreak.

Summary

- Avian influenza surveillance among animals and humans involves collaboration among many local, state, and federal agencies
- Surveillance among humans occurs routinely, and would be enhanced under an increased threat of pandemic influenza
- Surveillance among animals involves domestic, wild, and imported birds

In summary,

- Avian influenza surveillance among animals and humans involves collaboration among many local, state, and federal agencies
- Surveillance among humans occurs routinely, and would be enhanced under an increased threat of pandemic influenza
- Surveillance among animals involves domestic, wild, and imported birds

References

- USDA National HPAI Response Plan, Aug 2006, http://www.aphis.usda.gov/newsroom/hot_issues/avian_influenza/contents/printable_version/DraftSummaryNationalHPAIresponseplan08-31-06.pdf
- An early detection system for highly pathogenic H5N1 avian influenza in wild migratory birds, U.S. Interagency Strategic Plan, March 2006, http://www.doi.gov/issues/birdflu_strategicplan.pdf
- Morgan, A. Avian influenza: an agricultural perspective. *J Infect Diseases*. 2006;194(Suppl 2):S139-S146

References

- USDA'S Role in the Implementation Plan for the National Strategy for Pandemic Influenza, May 6, 2006, http://www.usda.gov/documents/AI_Fact_Sheet_Implementation_Plan.pdf
- USDA Avian Flu Brochure <http://www.usda.gov/documents/AvianFluBrochure.pdf>
- US Department of the Interior, Issues of Interest: Avian Influenza (Bird Flu). <http://www.doi.gov/issues/avianflu.html>
- WHO Case Definitions: http://www.who.int/csr/disease/avian_influenza/guidelines/case_definition2006_08_29/en/print.html

Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans

Exercises

Exercise 1

Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans

Objectives:

Group members will be able to find NAHLN laboratories, describe when to report a potential case of avian influenza among poultry or humans, know techniques to enhance influenza surveillance, and apply avian influenza case definitions to human cases.

Instructions:

For this exercise, you and your group will discuss human and animal surveillance components of an outbreak of avian influenza in poultry. You will be presented with information followed by a series of questions. Your facilitator or one person in your group should read the information aloud to group members, and the questions should be discussed as a group. You may want to reference the National Animal Health Laboratory Network (NAHLN) handout during this exercise. This scenario was based on a Canadian outbreak presented at the 2004 Canadian Poultry Service Industry Workshop.¹

Time allotted: 1.5 hours

Background: Day 1

The owner of a broiler breeder farm in Page County, Virginia, noticed that his flock of 9,000 broiler breeder chickens (Flock A) took double the normal time to consume the allotted amount of feed, and noted a slight increase in mortality. The adjacent flock of 9,000 (Flock B) was clinically normal. The farm owner suspected an issue with a recently delivered load of feed and contacted his veterinarian.

Day 3

The veterinarian visited the farm 2 days later. A sample of eight dead Flock A birds was submitted to Harrisonburg Regional Animal Health Laboratory of the Virginia Department of Agriculture for further investigation. The suspect load of feed was removed and immediately replaced with fresh feed.

¹ Stewart Ritchie, Canadian Poultry Consultants. *The First Case of AI in British Columbia-2004: An Account*. Available at <http://www.poultryworkshop.com/2004%20abstracts.htm>.

Question 1 – Does it matter which laboratory the samples were sent to? Hint, see NAHLN handout.

Suggested Answer – *Testing for AI should be done at a USDA-approved laboratory with the capability of running the test. The handout indicates that the Harrisonburg laboratory is approved to conduct avian influenza (AI) and Exotic Newcastle Disease (END) tests.*

Question 2 – Should this problem be reported (i.e. to the state or national Department of Agriculture)?

Suggested Answer – *At this point, it is probably too early to report the apparent outbreak, as it could be due to a number of illnesses, some of which might not be reportable, and the mortality is low. There are mandatory reporting requirements in place for detection of LPAI and HPAI, but in this instance there is not enough clinical or laboratory evidence yet to support the need to report.*

The USDA National HPAI Response Plan specifies clinical case definitions for highly pathogenic avian influenza in poultry. A flock with one or more of the following symptoms would be classified as exposed or infected with HPAI:

- *reduction in normal vocalization; listlessness; conjunctivitis; drops in egg production sometimes with pale, misshapen or thin-shelled eggs*
- *Respiratory signs such as rales, snicking, and dyspnea*
- *Neurological signs such as incoordination or torticollis*
- *A drop in feed and/or water consumption*
- *Swollen or necrotic combs and wattles*
- *Swollen head and legs*
- *Subcutaneous hemorrhage of legs*
- *Lungs filled with fluid and blood*
- *Tracheitis and airsacculitis*
- *Petechial hemorrhages on internal organs*

With or without the symptoms listed above, an unusual spike in mortality would also classify a flock as exposed or infected with HPAI. Unusual mortality is defined as:

- *Commercial broilers: exceeding 4 per 1,000 for 2 consecutive days*
- *Commercial layers: 4x normal daily mortality for 2 consecutive days OR 5% drop in egg production over 3 days*
- *Commercial turkeys: exceeding 2 per 1,000 per day*
- *Backyard flocks: any sudden or significant mortality or drop in egg production*

In this case, we do not have the exact mortality among Flock A, but we can presume it does not exceed 4 per 1,000.

Question 3 – What surveillance activities for avian influenza should the local and State health departments be conducting on a ‘normal day’?

Suggested Answer – *In the absence of HPAI in the US, surveillance activities will focus on human influenza. At the local level, health departments should be working with healthcare providers to report influenza and influenza-like illness (if they are part of a surveillance network) and to educate them on symptoms and procedures in the case of potential HPAI. Local health departments should also be investigating any epidemiologically unusual cases of severe influenza or influenza-like illness, such as investigating severe influenza in healthy adults and travelers, and clusters among health care workers. Specific activities related to HPAI depending on the jurisdiction.*

At the state level, the health department should be compiling and evaluating data from local departments, conducting surveillance of mortality due to influenza and influenza-like illness, and providing local health departments with a strong pandemic response plan. Again, cases of severe acute respiratory illness are the primary surveillance target, but these won’t be of particular concern if there is no reason to suspect avian influenza.

At both the local and state level, surveillance for both respiratory morbidity and mortality should occur.

Discussion Question – What specific surveillance activities has your state or local health department initiated in preparation for potential pandemic influenza?

Facilitator – *Encourage participants to share the activities from their own jurisdictions.*

Day 4

Preliminary results by real-time reverse-transcriptase PCR on the Flock A birds indicate an H5 influenza virus. The farm owner and referring veterinarian immediately implement “self-quarantine” and ensure that all biosecurity measures are in place.

Question 4 – Now should this problem be reported to the state or national Department of Agriculture?

Suggested Answer – *Yes. It is likely that the Harrisonburg laboratory will report the results to the state, and the state will report to the USDA; however, the farm owner and/or veterinarian may also wish to take action to report the preliminary diagnosis.*

Question 5 – What agencies, other than the USDA, or individuals should be informed of the preliminary lab results?

Suggested Answer – *Some agencies/individuals may include:*

- *Other area poultry farmers*
- *Poultry industry with interests in the area*
- *Local and/or state health departments*
- *The Centers for Disease Control*
- *State/US Wildlife*
- *The general population – to prepare them for potentially important updates*

Question 6 – If the final diagnosis turns out to be a low-pathogenic strain of avian influenza, would it still be important to report this outbreak?

Suggested Answer – *Yes. The State Department of Agriculture will want to assure that the virus does not spread any further, regardless of the strain, and will initiate culling of the flock. Low-pathogenic (LPAI) strains may still cause some agricultural losses, and they have the potential to mutate into a more virulent strain. From a public health perspective, there is minimal risk to human health posed by LPAI.*

Day 8

USDA was notified of the H5 diagnosis. Mortality in flock A increased to 1.3 % and egg production dropped approximately 20% over a period of 7 days. On Day 8, the Harrisonburg Regional Animal Health Laboratory reported that low pathogenic avian influenza (LPAI) subtype H5N2, was isolated from the submitted poultry samples.

Question 7 – What action, if any, should Agriculture take upon confirming low-pathogenic avian influenza on a poultry farm?

Suggested Answer – *The State Department of Agriculture will need to take steps to clean, disinfect, and depopulate the affected premises. This may be a good time to reinforce training for procedures to handle HPAI.*

Question 8 – What action should public health take upon hearing a report of low-pathogenic avian influenza on a poultry farm? Consider that LPAI has the potential to mutate to HPAI.

Suggested Answer – Although there is minimal threat to human health from LPAI, public health should be prepared to deal with a worried public. Coordination between animal and public health agencies is required. Communication will be the most important action to take, including educating farm workers and the public about the low risk due to this outbreak. This is also a ‘teachable moment’ for educating farm workers and those who may handle poultry in their occupation or for cooking about influenza prevention techniques through hygiene and appropriate personal protective equipment. Ensure that farm workers and others who are exposed to poultry receive the seasonal influenza vaccine.

It is also a good time for public health workers to review their routine and special surveillance activities and data, as well as their avian influenza response plan. They should prepare to enhance human surveillance in the area. Some methods of doing this include the following:

- *Active case finding among occupationally exposed*
- *Sensitization of community to report to health facilities.*
- *Add non-public practices delivering healthcare to reporting network including private practices*
- *Expand SARI and/or ILI surveillance to more local hospitals, occupational groups*
- *Train all in the reporting network on procedures (forms, time for reporting, where, etc.)*
- *Door-to-door surveys inquiring about ill people and chickens*
- *“Creative” integration into local communication networks*
- *Telephone reporting hotlines*

Day 10

Plans were set to depopulate Flock A and thoroughly disinfect the barn. On Day 10 the younger Flock B in the adjacent barn experienced a very sudden increase in mortality. In this flock of 9,000 birds the mortality increased from 4 birds per day to 96, then 930 and then the owner reported that mortality was too numerous to count. On the first day of increased mortality samples of dead birds from Flock B were submitted for further investigation to the Harrisonburg Regional Animal Health Laboratory. Based on the gross pathology, the sudden extreme increase in mortality and the previous diagnosis of AI virus in Flock A, an initial diagnosis of highly pathogenic AI (HPAI) was made by the Harrisonburg lab.

Question 9 – What new surveillance activities should the agencies involved undertake? How can public health enhance surveillance for avian influenza in light of the confirmation of the virus in poultry?

Suggested answer – *In health departments, contacts – i.e. those who were in contact with the poultry and poultry products – should be monitored for 10 days for possible influenza symptoms. Healthcare workers, the occupationally exposed, and those who have traveled to the Page Farm should be actively monitored for symptoms.*

Health departments should activate plans to conduct active surveillance for cases of severe viral respiratory illness. Surveillance should be enhanced in local hospitals and outpatient clinics.

Enhancing surveillance: In this case, when there have been no human cases, close monitoring of cases of severe respiratory illness and testing them for H5N1 will be critical, as well as monitoring cases of mild illness in people who have known contact with sick or dead birds. Primary concern would be those who may have had poultry contact. If poultry firms have occupational health doctors that care for workers, include these physicians in your surveillance network.

Active surveillance conducted by contacting and/or conducting periodic audits of hospitals, emergency and outpatient facilities, diagnostic laboratories, and physician's offices is one way to enhance surveillance. Surveillance data should be reported in daily, to allow for rapid response for treatment and containment. If the number of people exposed to the virus remains small, those at high risk could be screened for H5N1.

If human-to-human transmission is a concern, non-traditional sources of data such as school nurses, pharmacies, 911-calls, etc, might be used. However, these would be more useful for detecting a population-level increase of influenza (mostly likely seasonal), and would not be as useful for detecting individual cases of a novel influenza strain.

On the animal side, surveillance should be initiated among poultry at neighboring farms, and active surveillance of the local wild birds should be undertaken.

Discussion Question – What networks are in place in your jurisdiction to bring together health, agriculture, vet, and wildlife in order to make decisions quickly on what surveillance activities should be undertaken and how?

Facilitator – *Decisions to expand surveillance to neighboring farms, etc, need to be made quickly and to involve all the stakeholders. Navigating these decisions will be easier if the plan and infrastructure is already laid. Encourage participants to share what they know about joint decision making in their jurisdictions.*

Question 10 – Human surveillance based on clinical criteria will yield a large number of false positives. What epidemiologic context and/or clinical criteria should be employed as a red flag or trigger for raising the suspicion potential human cases of avian influenza to a higher level? At which point should a pandemic response plan be enacted?

Suggested answer – *The CDC Case Definition should initially be used as a measure of potential cases (shown at the end of this document). However, these were developed for the current US situation, in which there has been no identification of H5N1 virus on US soil.*

The Influenza Division has drafted the following “trigger” criteria. In the case of an outbreak of H5N1 among poultry in the US, criteria such as these may reflect cases with a link to AI or possible pandemic influenza. Participants should be allowed to discuss what they think might be appropriate criteria. Record consensus answers, and share this list after discussion is complete (or use this list to prompt discussion).

- *Cases with occupational exposure such as health care workers exposed to severe acute respiratory illness (SARI) cases or workers in poultry industry*
- *Clusters of 2 or more cases occurring within 7-10 days of each other from a group of people with a social or occupational connection*
- *Cases associated with sick or dying poultry or wild birds*
- *Cases with a history of travel within the last 10 days to an area known to have circulating avian influenza*
- *Trends in the data:*
 - *Increases in cases at a hospital compared to the same time in previous years*
 - *Other important events: e.g. reports of excessive poultry deaths should be investigated for associated human cases*
- *Rumors from newspapers or other sources*
- *Influenza isolates or tests that can't be typed*

Pandemic response plans should probably contain criteria for when to enact them; however a suspected or confirmed identification of HPAI in animals or people on US soil, such as listed in the potential triggers above, is probably enough reason to enact the response plan.

Discussion Question – Enhanced surveillance will increase the workload for hospitals and labs as well as the investigating agencies. This may overwhelm hospitals and present a barrier to effectively enhancing surveillance. How can efficient surveillance and testing be accomplished diplomatically, especially in the absence of human cases to give urgency to the situation?

Facilitator – *Encourage group members to share their words of wisdom about tactfully accomplishing this goal.*

Question 11 –What problems do you foresee in conducting surveillance for potential human cases of avian influenza?

Suggested answer – *Some potential problems or barriers may be:*

- *Before established human-to-human transmission, there will be many cases of influenza-like illness detected that do not turn out to be a novel illness (false positives)*
- *Public awareness of AI surveillance activity may increase anxiety, leading to a high need for public communication and correspondence*
- *Potential language barriers between public health workers and poultry farm workers (can be overcome with planning)*
- *Identified cases of respiratory illness will need to be triaged for investigation based on the index of suspicion. Exposures such as the trigger points listed in Question 10 will receive higher priority*
- *Public health may not have a good enough understanding of how the poultry industry works to identify those at highest risk of having (had) exposure*
- *People may not report symptoms due to fear of job related implications or fear of being ostracized from the community*

Question 12 – See the WHO and CDC case definitions at the end of this document. Which set would you use as guidance, and why? Develop case definitions for potential human cases surrounding this outbreak.

Suggested answer – *The WHO case definitions are designed to use for reporting purposes and to create standardization of data across different countries and regions. The CDC case definitions are similar, but are designed to be used in and adapted to outbreak situations. The CDC set would be appropriate to use as a starting point in this investigation, and can be used as guidance for determining which cases should receive laboratory testing. The case definition should be modified to include details of the current outbreak.² An example is below.*

A suspect case is a person who:

- *Has had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and at least one following symptoms - cough, sore throat, and/or respiratory distress.*

and

- *Has had one of the following exposures within 10 days of the first symptom:*
 - *direct contact with (e.g., touching) sick or dead poultry on the Page County Farm*
 - *direct contact with surfaces contaminated with poultry feces at the Page County farm*

² Case definitions and investigation guidelines are undergoing revision by WHO and CDC. Please check for updated recommendations and definitions at the organization websites.

- *consumption of raw or incompletely cooked poultry or poultry products, including blood, from the farm*
- *close contact (within 3 feet) of a symptomatic person who was confirmed or suspected to have H5N1 influenza*

and

- *Has a laboratory test for H5N1 that is pending, inadequate, or unavailable.*

A confirmed case is a person who:

Note: in an outbreak situation the laboratory and testing method may be specified.

- *Meets the clinical and exposure criteria for a Suspect Case (see above)*

and

- *Has a positive test for H5N1 influenza by one or more of the following methods:*
 - *isolation of an H5N1 influenza virus by viral culture*
 - *positive reverse transcriptase–polymerase chain reaction (RT-PCR) for H5N1*
 - *positive immunofluorescence antibody test for H5 antigen, using H5N1 monoclonal antibodies*
 - *4-fold rise in H5N1-specific antibody titer detected by microneutralization assay in paired serum samples*

Day 11: Conclusion

On Day 11, the USDA declared that the federal government was in control of this outbreak, the farm was placed under quarantine and provisions were made for the euthanasia and depopulation of the two flocks. The second flock would eventually yield highly pathogenic avian influenza (HPAI) that was a mutated form of the LPAI from the first barn. No human cases were ever detected.

WHO case definitions for human infections with influenza A(H5N1) virus

29 August 2006

Background

Prompt and accurate reporting of H5N1 influenza cases to WHO is the cornerstone for monitoring both the global evolution of this disease and the corresponding risk that a pandemic virus might emerge. In collaboration with several partners, WHO has developed standardized case definitions to facilitate:

1. Reporting and classification of human cases of H5N1 infection by national and international health authorities.
 2. Standardization of language for communication purposes.
 3. Comparability of data across time and geographical areas.
-

Application of the H5N1 case definitions

1. The case definitions apply to the current phase of pandemic alert (phase 3) and may change as new information about the disease or its epidemiology becomes available.
 2. National authorities should formally notify only probable and confirmed H5N1 cases to WHO. The case definitions for persons under investigation and suspected cases have been developed to help national authorities in classifying and tracking cases.
 3. The case definitions are not intended to provide complete descriptions of disease in patients but rather to standardize reporting of cases.
 4. In clinical situations requiring decisions concerning treatment, care or triage of persons who may have H5N1 infection, those decisions should be based on clinical judgment and epidemiological reasoning, and not on adherence to the case definitions. While most patients with H5N1 infection have presented with fever and lower respiratory complaints, the clinical spectrum is broad.
-

Case definitions

Person under investigation

A person whom public health authorities have decided to investigate for possible H5N1 infection.

Suspected H5N1 case

A person presenting with unexplained acute lower respiratory illness with fever ($>38^{\circ}\text{C}$) and cough, shortness of breath or difficulty breathing.

AND

One or more of the following exposures in the 7 days prior to symptom onset:

- a. Close contact (within 1 metre) with a person (e.g. caring for, speaking with, or touching) who is a suspected, probable, or confirmed H5N1 case;
- b. Exposure (e.g. handling, slaughtering, defeathering, butchering, preparation for consumption) to poultry or wild birds or their remains or to environments contaminated by their faeces in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month;
- c. Consumption of raw or undercooked poultry products in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month;
- d. Close contact with a confirmed H5N1 infected animal other than poultry or wild birds (e.g. cat or pig);
- e. Handling samples (animal or human) suspected of containing H5N1 virus in a laboratory or other setting.

Probable H5N1 case (notify WHO)

Probable definition 1:

A person meeting the criteria for a suspected case

AND

One of the following additional criteria:

- a. infiltrates or evidence of an acute pneumonia on chest radiograph plus evidence of respiratory failure (hypoxemia, severe tachypnea)

OR

b. positive laboratory confirmation of an influenza A infection but insufficient laboratory evidence for H5N1 infection.

Probable definition 2:

A person dying of an unexplained acute respiratory illness who is considered to be epidemiologically linked by time, place, and exposure to a probable or confirmed H5N1 case.

Confirmed H5N1 case (notify WHO)

A person meeting the criteria for a suspected or probable case

AND

One of the following positive results conducted in a national, regional or international influenza laboratory whose H5N1 test results are [accepted by WHO as confirmatory](#):

- a. Isolation of an H5N1 virus;
- b. Positive H5 PCR results from tests using two different PCR targets, e.g. primers specific for influenza A and H5 HA;
- c. A fourfold or greater rise in neutralization antibody titer for H5N1 based on testing of an acute serum specimen (collected 7 days or less after symptom onset) and a convalescent serum specimen. The convalescent neutralizing antibody titer must also be 1:80 or higher;
- d. A microneutralization antibody titer for H5N1 of 1:80 or greater in a single serum specimen collected at day 14 or later after symptom onset and a positive result using a different serological assay, for example, a horse red blood cell haemagglutination inhibition titer of 1:160 or greater or an H5-specific western blot positive result.



Interim Case and Contact Classification Guidelines

The case and contact classifications outlined below have been developed as preliminary guidance for use in the event of an avian influenza A (H5N1) outbreak in U.S. domestic poultry and should be adapted, as necessary, for the specific outbreak conditions. This guidance is based on the current state of knowledge regarding human infection with influenza A (H5N1) viruses; however, it may be modified for use during poultry outbreaks caused by other notifiable avian influenza viruses. As of this writing, influenza H5N1 has not been identified among animals or humans in the United States. In addition, no sustained human-to-human transmission of influenza H5N1 has been documented anywhere in the world, consistent with WHO Pandemic Phase 3 (Pandemic Alert Period)*. This guidance will be updated as our knowledge of the epidemiology of influenza H5N1 changes.

Cases are classified as follows:

A suspect case is a person who:

- Has had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and at least one following symptoms - cough, sore throat, and/or respiratory distress.

and

- Has had one of the following exposures within 10 days of the first symptom:
 - direct contact with (e.g., touching) sick or dead domestic poultry
 - direct contact with surfaces contaminated with poultry feces
 - consumption of raw or incompletely cooked poultry or poultry products, including blood
 - close contact (within 3 feet) of an ill patient who was confirmed or suspected to have H5N1 influenza
 - works with live H5N1 influenza virus in a laboratory.

and

- Has a laboratory test for H5N1 that is pending, inadequate, or unavailable.
 - Examples might include persons who died prior to testing or for whom testing can not be done, and persons with a positive result for influenza A by rapid antigen testing alone;

A confirmed case is a person who:

- Meets the clinical and exposure criteria for a Suspect Case (see above)

and

- Has a positive test for H5N1 influenza by one or more of the following methods:
 - isolation of an H5N1 influenza virus by viral culture
 - positive reverse transcriptase–polymerase chain reaction (RT-PCR) for H5N1
 - positive immunofluorescence antibody test for H5 antigen, using H5N1 monoclonal antibodies
 - 4-fold rise in H5N1-specific antibody titer detected by microneutralization assay in paired serum samples

Note: If a person tests positive by any of the methods above, but does not meet the clinical and exposure criteria, they may still be counted a confirmed H5N1 infections and treated as a confirmed case for the purpose of the investigation and follow-up.

A report under investigation is a person who

- Does not fulfill the suspect case criteria, in terms of exposure or clinical characteristics because information is not yet available. Additional information is needed to classify into one of the other case classifications.

Not a case

- Negative for H5N1 influenza as determined by sensitive laboratory testing methods with adequate and appropriately timed specimens.

Surveillance for Highly Pathogenic Avian Influenza among Animals and Humans

Background Information

Surveillance for Avian Influenza among Humans and Animals



Welcome to the Rapid Response Training: The Role of Public Health in a Multi-Agency Response to Avian Influenza in the United States. This training will be executed primarily in smaller group breakout sessions, where you will work on case studies and table top exercises. This presentation offers a brief introduction to the first session: Surveillance for Avian Influenza among Humans and Animals.

Learning Objectives

- Understand current surveillance for avian influenza in poultry, wild birds, and humans
- Understand enhanced human surveillance in response to a highly pathogenic avian influenza outbreak in poultry or wild birds

The learning objectives of this module are the following:

- To understand current surveillance for avian influenza in poultry, wild birds, and humans
- and
- To understand enhanced human surveillance in response to a highly pathogenic avian influenza outbreak in poultry or wild birds

Presentation Overview

- Federal Agencies
- Human Influenza Surveillance
 - Routine
 - Enhanced
- Animal Influenza Surveillance
 - Poultry
 - Wild Birds

We will begin this presentation by introducing the federal agencies that are primarily involved in conducting human and animal avian influenza surveillance.

Next, we will discuss surveillance for human influenza, starting with routine surveillance and elaborating on enhanced surveillance that would take place in case of a pandemic alert.

Finally, we will discuss surveillance for avian influenza among domestic poultry and wild birds.

Federal Agencies

- US Department of Health and Human Services (DHHS)
 - CDC
- US Department of Agriculture (USDA)
- US Department of the Interior (DOI)

There are three federal agencies involved in influenza surveillance for poultry, wild birds, and humans. They are the US Department of Agriculture (USDA), the US Department of the Interior (DOI), and the US Department of Health and Human Services (DHHS), including the Centers for Disease Control (CDC). Here we will briefly discuss surveillance activities of each of these agencies.

HHS

Lead agency for avian influenza in humans

- Tasks:
 - Pandemic influenza planning
 - Human surveillance
 - Rapid response to HPAI in humans

The US Department of Health and Human Services is the lead agency for avian influenza in humans. HHS is responsible for pandemic influenza planning, including delineating federal plans and preparation for public health and medical support in the event of a pandemic, and providing guidelines for state and local policy makers and health departments. Some HHS efforts are conducted largely by the Centers for Disease Control and Prevention (CDC), including surveillance for human cases of avian influenza as well as leading and coordinating rapid response to HPAI in humans.

USDA

Lead agency for avian influenza in poultry

- Tasks:
 - International assistance
 - Import restrictions
 - Surveillance among domestic poultry
 - Rapid response to HPAI
- Coordinates with states and industry

The United States Department of Agriculture, or the USDA, plays a large role in the control of avian influenza in the US. It is an executive agency within the US government whose purpose is to develop and execute policy over a wide range of areas concerned with the production and trade of food. Among the aims of the USDA are to meet the needs of farmers and ranchers, promote agricultural trade and production, and to work to assure food safety. All of these tasks may concern avian influenza at some level.

The USDA plays either a leadership or coordinating role in 98 critical actions as the lead agency on avian influenza in poultry. This includes initiatives such as continuing to support the coordinated efforts internationally to slow the spread of the disease in poultry; import restrictions on animals and products into the US that could be infected with influenza; conducting domestic testing and running early warning surveillance systems; and ensuring USDA has a strong plan in place to rapidly and decisively respond to a detection of highly pathogenic H5N1 in U.S. poultry, in coordination with states and industry.

DOI

Collaborating agency for avian influenza in wild birds

- Tasks:
 - Surveillance among wild migratory birds
 - Protects health of employees and visitors on more than 500 million acres of federal lands
 - Rapid response to HPAI in wild migratory birds
 - Collaborates with USDA

The Department of the Interior is involved with monitoring and testing wild migratory birds for HPAI because the Department has authority for managing and protecting wildlife, including migratory birds, under various laws and treaties. In addition, Interior has responsibility for protecting the health of employees and visitors on more than 500 million acres of federal lands across the nation. Interior also has a major responsibility to provide the public timely, accurate, and consistent information about avian influenza developments as they relate to Interior programs and activities.

As Interior's primary science and research agency, the US Geological Survey (USGS) has a long history of responding to wildlife disease emergencies and conducting wildlife disease investigations. The US Fish and Wildlife Service (FWS) has primary responsibility for managing the nation's wildlife. FWS administers the National Wildlife Refuge System, with many of its 545 refuges providing critical nesting, migration, and wintering habitat for waterfowl and other migratory birds. FWS also works with the U.S. Department of Agriculture (USDA) at major U.S. air and sea ports to regulate the importation of wild birds for the pet trade, research, and other purposes.



Influenza Surveillance Among Humans

In the second part of this session, we will present information on influenza surveillance among humans.

Routine National Surveillance

1. Virologic - laboratory reporting
2. Sentinel Providers Network
3. State and territorial epidemiologists reports
4. Emerging Infections Program
5. New Vaccine Surveillance Network
6. 122 Cities Mortality Reporting System
7. Influenza-associated pediatric mortality

There are 7 components to routine influenza surveillance conducted by the CDC. The first, laboratory reporting by WHO and National Respiratory and Enteric Virus Surveillance System (NREVSS) collaborating labs, is virologic surveillance. In other words, this component relies on positive identification of an influenza virus by a laboratory. The other 6 components to the surveillance system are disease-based, relying on a clinical diagnosis of influenza:

- The Sentinel Providers Network. This is a network of approximately 1,200 healthcare providers nationally that report influenza-like illness (ILI) during flu season.
- State-level surveillance. State and territorial epidemiologists report the level of influenza activity in their state (no activity, sporadic, local, regional, or widespread).
- The Emerging Infections Program. This program tracks laboratory-confirmed influenza-related hospitalizations for 12 metropolitan areas in 10 states.
- The New Vaccine Surveillance Network, which tracks laboratory-confirmed influenza-related hospitalizations for children under 5 in 3 US counties.
- 122 Cities Mortality Reporting System. This system tallies the vital statistics from 122 cities that report deaths due to pneumonia and influenza (P&I).
- Influenza-associated pediatric mortality –these are deaths related to influenza for children under 18, which is a nationally notifiable condition.

Routine State-Level Surveillance

- Monitor sentinel provider network data
- Monitor laboratory data
- Conduct mortality surveillance
- Provide state-level assessments based on state-specific surveillance
- Passive reporting of outbreaks in long-term care facilities and schools

Routine influenza surveillance at the state level is linked to that at the national level. States monitor data from sentinel providers in their state, conduct virologic surveillance from state labs, conduct influenza-related mortality surveillance, and provide the CDC with state-level assessments based on activities specific to each state. Many states also have passive reporting of ILI outbreaks in schools and long-term care facilities.

Some state-specific activities may include school-based syndromic surveillance (for example Michigan, Maine), electronic reporting of ILI from emergency rooms (for example North Carolina, New York, and Pennsylvania), antiviral prescription trends (such as California and New York), or EMS data (as in Georgia).

Routine Local-Level Surveillance

- Monitor local data from sentinel providers
- Investigate and report influenza-related pediatric mortality
- Investigate clusters of influenza-like illness (ILI) that are
 - a) outside of regular flu season, or
 - b) in nursing homes or healthcare facilities
- Area-specific activities

Routine surveillance at the local level differs based on the size and resources of the area, among other factors. However, elements that are common to many local surveillance systems include: monitoring of data from local sentinel providers, investigating and reporting cases of influenza-related pediatric mortality, investigating clusters of influenza-like illness that are outside of the regular flu season, or in institutions like nursing homes or healthcare facilities. Many local health departments conduct other activities in addition to these.

Local Surveillance During Pandemic Alert

Continue routine surveillance activities AND

- Investigate clusters of influenza-like illness with a) recent travel to area with documented novel or avian flu, or b) severe morbidity and mortality
- Facilitate viral testing for persons with ILI and epidemiologic risk factors

Local surveillance during the pandemic alert period includes ongoing routine surveillance activities and investigation of clusters of influenza-like illness associated with recent travel to an area with documented novel or avian flu, or clusters of ILI that are associated with severe morbidity and mortality. During this phase, local health departments may also facilitate viral testing for persons with ILI and epidemiologic risk factors.

CDC Guidance for the Current Situation: Enhanced Surveillance

Testing for avian influenza A (H5N1) virus infection is recommended for:

A patient who has an illness that:

- Requires hospitalization or is fatal; AND
- Has or had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$); AND
- Has radiographically confirmed pneumonia, acute respiratory distress syndrome (ARDS), or other severe respiratory illness for which an alternate diagnosis has not been established; AND
- Has at least one of a list of potential exposures within 10 days of symptom onset:

Look to CDC guidance for the current surveillance recommendations. Testing for avian influenza A (H5N1) virus infection is recommended for:

A patient who has an illness that:

- requires hospitalization or is fatal; **AND**
- has or had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$); **AND**
- has radiographically confirmed pneumonia, acute respiratory distress syndrome (ARDS), or other severe respiratory illness for which an alternate diagnosis has not been established; **AND**

has at least one of the following potential exposures within 10 days of symptom onset:

CDC Guidance: Exposures

Exposures to investigate if within 10 days of illness onset

- History of travel to a country with influenza H5N1 documented in poultry, wild birds, and/or humans, AND had at least one potential exposure (i.e. sick poultry) during travel
- Close contact (approach within 3 feet) of an ill patient who was confirmed or suspected to have H5N1
- Worked with live influenza H5N1 virus in a laboratory

1. History of travel to a country with influenza H5N1 documented in poultry, wild birds, and/or humans, **AND** at least one of the following potential exposures during travel:

- direct contact with (e.g., touching) sick or dead domestic poultry
- direct contact with surfaces contaminated with poultry feces
- consumption of raw or incompletely cooked poultry or poultry products
- direct contact with sick or dead wild birds suspected or confirmed to have influenza H5N1
- close contact (approach within 1 meter) of a person who was hospitalized or died due to a severe unexplained respiratory illness

2. Close contact (approach within 1 meter) of an ill patient who was confirmed or suspected to have H5N1.

3. Worked with live influenza H5N1 virus in a laboratory.

Enhancing Local Surveillance

- Enhance surveillance and record review in hospitals
- Public Service Announcements
- Telephone hotlines
- Door-to-door surveys
- Occupational surveillance

On a practical level, enhancing surveillance for cases meeting these criteria can be accomplished through several different methods. Hospitals will be a primary source for detecting severe respiratory illnesses. Emergency department records and discharge data are two ways of specifically looking for cases in hospitals.

Public service announcements, carefully designed to have a clear and simple message, can alert the general public to see their doctor if they have specific symptoms and/or exposures. Alternatively, you may want to publicize a telephone hotline, where the public can ask questions and also report suspect cases.

Door-to-door surveys in a locally-defined area where cases are most likely can also turn up cases and/or people at high risk of exposure.

Finally, surveillance among high risk occupations such as poultry workers and healthcare workers is clearly a way to keep track of symptoms that may develop among those with potential exposures.

Goals of Human Surveillance for Pandemic Influenza

- Virologic Surveillance
 - Detect initial cases of pandemic strain
 - Track introduction of virus to local areas
 - Monitor changes in virus
- Disease-based Surveillance
 - Early warning of increased ILI
 - Monitor health effects of pandemic
 - Track trends in disease activity

As stated in the HHS Pandemic Influenza Plan, the primary goals for influenza surveillance during a pandemic are:

For surveillance of viruses (virologic surveillance):

- rapidly detect initial cases of pandemic strain,
- track the introduction of the virus into local areas, and
- monitor changes in the virus, including antiviral resistance.

For surveillance of influenza-associated illness and death (disease surveillance):

- serve as early warning for increase in influenza-like illness in the community,
- monitor the effect of the pandemic on health, and
- track trends in disease activity and identify most severely affected populations.

The last goal of disease-based surveillance will be important in deciding which control measures to implement, and which groups should receive high priority for vaccine and antiviral use.

Human Surveillance

Upon confirmed HPAI in animal species...

1. Conduct active case finding
2. Assess exposures
3. Classify and test potential cases

The biggest change from routine surveillance to enhanced surveillance (upon HPAI in animals) is to conduct active case finding activities, which is more resource-intensive than relying on existing passive surveillance systems.

The three primary surveillance activities, once HPAI has been confirmed in animals, are: 1) active case finding, 2) exposure assessment, and 3) case classification and testing. The next several slides will address each of these major surveillance activities, and then specific actions that should be taken to complete these activities.

1. Active Case (and Contact) Finding

- Everyone with known or possible exposure 72 hours before bird symptoms
- Known or possible exposures
 - Infected poultry
 - Under- or uncooked infected poultry
 - Infected wild or pet birds
 - Manure and litter
 - Contaminated surfaces, vehicles, equipment, etc
 - Contaminated air space
 - Within 3 ft of infected person

The first surveillance activity is to perform active case and contact finding to identify persons with signs or symptoms of illness after exposure to HPAI—identify all persons who had known or possible exposures that occurred beginning 72 hours before birds showed clinical signs of illness. The 3-day exposure timeframe is based on the maximum time from experimental infection to death in birds (personal communication, D. Swayne, USDA Agricultural Research Service). Case finding will need to be coordinated with the animal health investigation (i.e., affected premises/farm traceout of poultry, poultry products, and materials). Known or potential sources of exposure include the following:

- infected poultry
- under- or uncooked poultry products from infected birds
- infected wild or pet birds
- other infected animals (e.g., pigs)
- manure and litter containing high concentrations of virus
- contaminated surfaces
- contaminated vehicles, equipment, clothing, and footwear at affected sites, such as poultry farms with outbreaks
- contaminated air space (e.g., a barn, hen-house, or the air space proximal to barn exhaust fans)
- Being within 3 feet of individuals known to be infected with an avian influenza virus

2. Exposure Assessment

- Characterize exposures
- Define target population
- Most likely to be exposed
 - Those involved in HPAI control and eradication
 - Poultry farm owners or employees, state and federal animal health agency employees

The second surveillance activity is to conduct an exposure assessment—Public health authorities should interview persons with known or possible exposure to avian influenza to epidemiologically characterize exposures and to define the target population.

There is relatively limited public health experience with avian influenza outbreaks, and variability has been observed in the epidemiology of avian influenza outbreaks caused by different strains. Therefore, it may be necessary to modify the list of sources of avian influenza virus as the outbreak progresses, more information becomes available, or the situation changes (e.g., if there is evidence of airborne spread of the virus from an avian source). It is expected that those most likely to be exposed at the beginning of an outbreak would include persons who are involved in HPAI control and eradication activities (e.g., poultry farm owners/employees and federal/state animal health agency employees) and who did not use or properly use personal protective measures. If human illness is observed, the exposure history of the infected individuals should be documented and used to evaluate infection control precautions that are in place. Close contacts of confirmed or suspect case-patients should be managed as described elsewhere in this training. If human-to-human transmission is suspected, then a complete exposure assessment should be conducted.

3. Classify and Test

- Classify the persons with severe or fatal respiratory disease as:
 - Suspect Case
 - Confirmed Case
 - Report Under Investigation
 - Not a Case
- Perform laboratory testing

The third surveillance activity is to classify and test those persons identified in surveillance activities who have a severe or fatal respiratory disease.

Cases should be classified according to the CDC guidelines as suspect, confirmed, a report under investigation, or not a case. The CDC has developed these interim case definitions for human infection with H5N1, in the event of an outbreak of highly pathogenic avian influenza in domestic poultry. Final case classification will depend on laboratory results, so laboratory testing should be performed.

Interim Case Definition (H5N1)

Suspect Case

- Must meet all of the following criteria:
 - Temperature of 100.4°F or higher
 - Cough, sore throat, or respiratory distress
 - Exposure within 10 days of symptom onset
 - Laboratory test pending, inadequate, or unavailable

The case definitions should be modified to reflect the epidemiology of an outbreak. It should be noted that the *outbreak* case definition is different from the WHO reporting case definition.

To be classified as a suspect case, a person must have a documented temperature of at least 100.4°F, either a cough, sore throat, or other respiratory distress

AND

- Exposure to one of the following within 10 days of the first onset of symptoms:
- Direct contact with sick or dead domestic poultry
- Direct contact with surfaces contaminated with poultry feces
- Consumption of raw or incompletely cooked poultry or poultry products, including blood
- Close contact (within 3 feet) of an ill patient who was confirmed or suspected to have H5N1 influenza
- Works with live H5N1 virus in a laboratory

AND

Has a laboratory test for H5N1 that is pending, inadequate, or unavailable.

Interim Case Definition (H5N1)

Confirmed Case

- Meets clinical and exposure criteria for a Suspect Case, but laboratory testing is inconclusive
- AND -
- Positive lab test for H5N1 by one of four methods

The CDC has developed an interim case definition for confirmed human infection with H5N1. This definition should be modified to reflect the epidemiology of an outbreak.

To be classified as a confirmed case, a person must meet the clinical and exposure criteria for a suspect case

AND

- Have a positive test for H5N1 influenza by one or more of the following methods:
- Isolation of an H5N1 influenza virus by viral culture
- Positive reverse transcriptase–polymerase chain reaction (RT-PCR) for H5N1
- Positive immunofluorescence antibody test for H5 antigen, using H5N1 monoclonal antibodies
- 4-fold rise in H5N1-specific antibody titer detected by microneutralization assay in paired serum samples

Note: If a person tests positive by any of the methods above, but does not meet the clinical and exposure criteria, they may still be counted a confirmed H5N1 infection and treated as a confirmed case for the purpose of the investigation and follow-up.

Interim Case Definition (H5N1)

Report Under Investigation

- Exposure or clinical information is not available
- Additional information is necessary to classify

A report under investigation is one that does not fulfill suspect case criteria for exposure or clinical characteristics because the information is not available. Additional information is necessary to classify this case, and often is in the process of being sought.

Poultry Outbreak and Human Surveillance Activities

- Limit case definition
- Disseminate case definition
 - Health Alert Network (HAN)
 - Epi-X
- Create and disseminate outbreak reporting questionnaire
- Consider database and reporting tools
- Identify and interview potential cases and contacts

In the event of an outbreak of HPAI among poultry, human surveillance activities should include the following actions:

- Limit the case definitions just listed to specific situations, including specific symptoms, the incubation period, defined exposures, and laboratory test results.
- Disseminate the outbreak case definition to outbreak investigators and others that might be involved in case detection (such as local physicians or hospitals). This can be done at the local level through the Health Alert Network, or through CDC's secure web-based system, Epi-X.
- Create and disseminate an initial outbreak reporting questionnaire to outbreak investigators.
- Consider database and reporting tools that will be used to store and summarize the collected data as well as assist with case and information management.
- Identify potential cases and contacts and administer the outbreak-reporting questionnaire. Further follow-up and communication will then be required for all individuals identified as potential case-patients and their contacts.

Surveillance Activities cont.

- Conduct surveillance for human illness linked to affected premises
- Ensure timely reporting of cases to CDC
- Characterize seasonal influenza strains
- Notify other states that might receive cases or contacts
- Advise contacts to monitor symptoms for 10 days post-exposure

- Conduct ongoing surveillance for human illness linked to affected premises.
- Ensure timely reporting of any suspect, probable, or confirmed human cases and reporting of control measures put in place, through the normal reporting channels (i.e., from local public health to state authority to CDC). This information dictates which pandemic phase the country is in, so it will also be shared with WHO.
- If the outbreak occurs during flu season, characterize human seasonal influenza strains currently circulating in or near the affected area(s) to differentiate avian and seasonal influenza.
- Notify any other states that might be receiving cases or contacts linked to the outbreak (e.g., workers involved in poultry control and eradication activities and who are returning to their home state). This notification should occur directly between states to avoid delays and should include (as permitted by state legislation) the individual's name and contact information as well as the status of the individual with respect to clinical illness and any required ongoing treatment and monitoring. Similarly, if contacts are being actively managed (e.g., daily active surveillance) as part of the outbreak response, these individuals should be referred to their respective state if the monitoring period has not been completed by the time the individual leaves the outbreak state.
- Advise contacts that they should be aware of the possibility of symptom development up to 10 days after last exposure. Should symptoms develop, contacts should be instructed to both see a physician and report their symptoms and possible exposure to a local public health authority. Although this may be part of surveillance activities, investigators should consider specialized data or laboratory specimen collection requirements and human subjects authorizations needed to facilitate near-term research studies to build the knowledge base for detection, prevention, and control of avian influenza in humans (e.g., laboratory testing for evidence of asymptomatic infection).

Contacts

Definition:

Asymptomatic individuals who have potentially been exposed as defined by the exposure criteria in the suspect case definition.

Active surveillance for influenza symptoms should take place among contacts. Contacts are those people who have been exposed to the virus but do not have clinical signs of illness.

The formal definition of contacts is: Asymptomatic individuals who have potentially been exposed as defined by the exposure criteria in the suspect case definition.

Possible Contacts

- Poultry workers
- Agriculture responders
- Farmers
- Veterinarians
- People purchasing poultry products
- Farm visitors
- Travelers

When conducting active case finding and contact tracing, here are some groups you should consider interviewing, because they may have direct contact with poultry: poultry workers, agriculture responders, farmers, veterinarians, people purchasing poultry products, farm visitors, and travelers.

Possible Contacts

Also:

- Healthcare workers
- Family members and other close contacts
- Emergency Medical Services staff

Additional groups that may be at risk include hospital workers, family members or other close contacts of suspected or confirmed cases, and Emergency Medical Services staff. These groups will be at especially high risk if human-to-human transmission is suspected or confirmed.

Recommendations for Contacts

- Self-monitor for symptoms for 10 days after last exposure
- Evaluate for antiviral prophylaxis
- Receive seasonal flu vaccine
- Adhere to infection control procedures

If symptoms develop, reclassify according to case definitions

The recommendations for contacts include the following:

- Self-monitor for fever, respiratory symptoms, diarrhea and/or conjunctivitis for 10 days after the last exposure to a known or suspected source of avian flu virus
- Evaluate for antiviral prophylaxis
- Vaccinate with seasonal influenza vaccine, if it is flu season and there are no prohibiting factors.
- Adhere to infection control procedures

It should be noted that monitoring of contacts could be more active depending on the epidemiology of the outbreak, whether there was significant delay in implementation of control measures, and/or the level of confidence that public health recommendations are being followed. One aspect of active monitoring could be phone calls to contacts for daily temperature recording.

In the course of following up contacts, if respiratory symptoms do develop, the contacts should be reclassified according to the case definitions being used, and then treated as a case.



Influenza Surveillance Among Animals

Animal Surveillance

Poultry:

- Live bird markets
- Commercial flocks
- Backyard flocks

Other Birds:

- Imported birds
- Wild birds
- Pet birds

USDA works with federal, state, and industry partners to monitor U.S. bird populations. Surveillance in poultry is conducted in three key areas: live bird markets, commercial flocks, and backyard flocks. Additional surveillance activities include monitoring of imported birds, (in collaboration with the Department of the Interior) monitoring of wild birds, and monitoring of pet birds.



Notifiable Avian Influenza (NAI)

*"Avian influenza in its notifiable form (NAI) is defined as an infection of poultry **caused by any influenza A virus of the H5 or H7 subtypes or by any AI virus with an intravenous pathogenicity index (IVPI) greater than 1.2 (or as an alternative at least 75% mortality) as described...** NAI viruses can be divided into highly pathogenic notifiable avian influenza (HPNAI) and low pathogenicity notifiable avian influenza (LPNAI)"*



In accordance with changes in 2006 to the World Organization for Animal Health (OIE) Code, all confirmed detections of H5 and H7 AI must be reported to State and Federal officials and to the OIE. This includes LPAI H5 and H7 subtypes because of their potential to mutate into highly pathogenic strains.

Therefore, USDA now tracks these detections in wild birds, backyard flocks, commercial flocks, and live bird markets.




- ✓Licensing
- ✓Bird testing and recordkeeping
- ✓Sanitation and biosecurity
- ✓Surveillance
- ✓Response



Live bird markets are common in larger metropolitan areas.

Historically, H5 and H7 subtypes of LPAI virus have been isolated from live bird markets (LBMs) in the United States. Since 1986, USDA’s APHIS and the States have been monitoring LBMs in the Northeastern United States for the presence of AI viruses that may pose a threat to commercial poultry.

Very recently, a control program for H5 and H7 viruses was instituted in the live bird markets. This control program requires licensing of suppliers, distributors and markets with very specific record keeping and testing requirements. Surveillance testing is conducted with a specifically required frequency at the markets. This testing includes individual bird testing as well as environmental testing.

Live Bird Markets

- Prevent and control LPAI
 - Markets
 - Production facilities
 - Distributors
- Regular monitoring and surveillance of all facilities in volunteer states
 - Quarterly random testing
 - Quarterly closure with depopulation, cleaning, disinfection and down time
- State-level monitoring in non-participating states

To address the persistence of LPAI associated with the live bird marketing system in the United States, USDA continues to institute a cooperative programs with states and industry to prevent and control the disease not only in the markets themselves, but also among production premises and poultry distributors that supply those markets. The program establishes an important relationship that requires commercial and noncommercial industries to work together to protect America's flocks.

A federal control and prevention program targeting the live bird marketing system involves regular monitoring and surveillance of all facilities in 21 voluntarily participating states. Those states with live bird markets that do not participate in the federal program have a state poultry surveillance program in place.

Live bird market surveillance includes quarterly random testing in the markets and poultry distributors. It also includes quarterly closure with depopulation, cleaning, disinfection, and down time of at least 24 hours (Morgan, A. Avian influenza: an agricultural perspective. *J Infect Diseases*. 2006;194(Suppl 2):S139-S146)

Commercial Flocks

National Poultry Improvement Plan (NPIP)

- USDA program
- Monitor poultry production facilities
- Random testing of flocks
 - Test all ill birds
- Coordinate with states for response and containment plans

The surveillance program in commercial poultry is administered through the National Poultry Improvement Plan (NPIP) and includes monitoring of poultry production facilities and random testing of poultry flocks with tests performed on all birds that appear ill. As part of the program, USDA has worked with states to develop state response and containment plans.

Surveillance: NPIP

- Establishes standards for evaluation of poultry breeding stock and hatchery products
- “Avian influenza free” certification for commercial companies



On-farm testing is extensive in the U.S.

The National Poultry Improvement Plan is a cooperative Industry-State-Federal program through which new technology can be effectively applied to the improvement of poultry and poultry products throughout the country.

The provisions of NPIP, developed jointly by industry members and State and Federal officials, establish standards for the evaluation of poultry breeding stock and hatchery products with respect to freedom from certain vertically-transmitted and hatchery-disseminated diseases, in order to provide certification of poultry and poultry products for interstate and international shipment.

Currently, the National Poultry Improvement Plan (NPIP) has a category for “Avian influenza free” certification for commercial companies that requires testing the flocks for AI. This on-going program helps commercial companies monitor their breeding flocks for LPAI.

Surveillance: NPIP (cont.)

- New LPAI program that will provide for H5 and H7 AI monitoring and indemnity for LPAI.
- Program components:
 -
 -
 -



NPIP is developing the commercial poultry segment of this program. NPIP participants have adopted a new LPAI program that will provide for H5 and H7 AI monitoring of participating broiler, table egg, and turkey production flocks and their respective breeding flocks. NPIP has expanded to provide 100 percent indemnity for costs associated with eradication of the H5/H7 subtypes of LPAI in poultry.

This program will have three components:

- Testing of poultry flocks in an “Avian Influenza Monitored” program;
- Specifications for surveillance at state NPIP authorized diagnostic laboratories to test all flocks submitted with a history suggestive of LPAI;
- and development of State LPAI response and containment plans.

The adopted program is currently proceeding through the regulatory process that will fully establish this voluntary program as part of the NPIP.

Domestic, Non-Commercial

Backyard Flocks

- “Biosecurity for the Birds” program
 - Report sick birds to an animal health professional
 - Practice biosecurity
- Collaborators
 - State Departments of Agriculture
 - USDA Cooperative Extension Service
 - Private veterinarians



The USDA’s Veterinary Services (VS) division is working with individual states on an emergency national disease surveillance program aimed at non-commercial poultry and bird owners. Through the “Biosecurity for the Birds” program, USDA encourages backyard and small poultry producers to strengthen biosecurity practices in order to prevent the introduction of AI into their flocks. This program provides important information about reducing the chances of these birds becoming infected with AI. The message of this program is very specific: report sick birds to an animal health professional and practice biosecurity. This program does not include routine testing of backyard poultry flocks.

To reach the target audience, USDA is working closely with:

- State Departments of Agriculture
- USDA’s Cooperative Extension Service
- Private veterinarians

About the Campaign <http://www.aphis.usda.gov/vs/birdbiosecurity/campaign.html>

Imported Birds

- USDA mandates quarantine and testing all imported birds for avian influenza
 - Poultry
 - Pet birds
 - Zoo birds
 - Ratites (i.e. ostriches and emus)
- Current ban on live or fresh birds or poultry from areas where the Asian strain H5N1 virus exists

USDA requires that imported birds (poultry, pet birds, birds exhibited at zoos, and ratites) be quarantined and tested for the avian influenza virus before entering the country. This precaution is taken to prevent foreign strains of AI from being introduced in the United States.

In addition to international import restrictions, the Animal and Plant Health Inspection Service (APHIS) of USDA has increased surveillance efforts to detect highly pathogenic avian influenza if it is accidentally introduced into the United States. APHIS and State veterinarians trained to diagnose foreign animal diseases regularly conduct field investigations of suspicious disease conditions. This surveillance is enhanced by efforts from university personnel, state animal health officials, USDA-accredited veterinarians, and industry representatives.

Beginning in February of 2004, the USDA issued a ban on live or fresh birds from countries where H5N1 virus exists. The list is updated as additional countries detect H5N1 in poultry. The ban does not cover processed poultry products, since processing would render them non-infectious.

Wildlife Surveillance

Five components to surveillance

- 1) Investigation of morbidity and mortality
- 2) Surveillance in live wild birds
- 3) Surveillance in hunter-killed birds
- 4) Sentinel species monitoring
- 5) Environmental sampling

One of the primary activities of the DOI is the testing of migratory birds for HPAI, with priority placed on birds in Alaska and the Pacific flyway, since those birds have a higher likelihood than others of mixing with birds from the East Asian and East Asian-Australasian flyways. The DOI has 5 primary strategies for surveillance. They are:

- Investigation of morbidity and mortality in wild birds
- Surveillance in live wild birds (focus on species with highest risk of exposure to or infection with H5N1 or other HPAI)
- Surveillance in hunter-killed birds (sampling occurs at hunter check-stations)
- Sentinel species monitoring (disease-free waterfowl, exhibition gamefowl, and backyard poultry flocks are used as sentinel species)
- Environmental sampling (both water and fecal material from waterfowl habitat)

Wild Bird Surveillance – The USG Interagency Strategic Plan

- Part of the President's National Strategy for Pandemic Influenza
- Partnership among:
 - U.S. Departments of Agriculture, Interior, Health and Human Services
 - Association of Fish and Wildlife Agencies
 - National Association of Public Health Veterinarians
 - State agencies
- Unified national system for early detection of highly pathogenic H5N1 AI in wild
- birds. Provides standard procedures and strategies for sampling, diagnostics and data management.



Wild birds, by their very nature, are not subject to disease containment controls as are domestic birds and people. Therefore, the ability to effectively control the spread of a highly infectious foreign animal disease, such as HPAI H5N1, is dependent upon the capacity to rapidly detect the pathogen if it enters the United States.

As part of the President's National Strategy for Pandemic Influenza, which includes both avian influenza and human pandemic preparedness, USDA and its partners developed an interagency strategic plan for the early detection of HPAI H5N1 in wild migratory birds. The plan outlines a multi-agency, national surveillance effort and includes standard procedures and strategies for data sampling, diagnostics, and management.

This plan serves as a guide to all Federal, State, university and non-governmental organizations involved in AI surveillance.

Migratory Birds

- Capture, sample, test
- Monitor and test wild birds
 - Alaska / Pacific flyway
 - Mississippi (Central) flyway
 - Atlantic flyway
- Collaborators: DOI, USDA, USGS, US Fish and Wildlife, state agencies, and others

The Department of the Interior, the U.S. Department of Agriculture, and a broad array of state, local and non-government partners are conducting expanded capture, sampling and testing programs to detect the highly pathogenic H5N1 avian influenza virus or other HPAI viruses in North American migratory birds. These efforts are guided by a coordinated and comprehensive interagency program that will provide an early warning to the agriculture, public health, and wildlife communities if migratory birds are found infected with HPAI. This early detection plan prioritizes survey efforts to focus on Alaska, elsewhere in the Pacific flyway, followed by the Central flyway, Mississippi flyway, and Atlantic flyway.

This program involves collaboration among the USGS, U.S. Fish and Wildlife Service, U.S. Department of Agriculture, state agencies (including Hawaii and U.S. Pacific Territories), and others.

Case Definition for Poultry

- Surveillance at the flock level, rather than individual level (as in human surveillance)
 - Clinical case definition of HPAI in poultry flocks
 - Symptoms of illness such as drops in egg production, lack of energy and appetite, nasal discharge, lack of coordination, swollen head and legs
- AND/OR
- Unusual mortality

The USDA National HPAI Response Plan specifies clinical case definitions for highly pathogenic avian influenza in poultry. A flock with one or more of the following symptoms would be classified as exposed or infected with HPAI:

- Reduction in normal vocalization; listlessness; conjunctivitis; drops in egg production sometimes with pale, misshapen or thin-shelled eggs
- Respiratory signs such as rales, snickering, and dyspnea
- Neurological signs such as incoordination or torticollis
- A drop in feed and/or water consumption
- Swollen or necrotic combs and wattles
- Swollen head and legs
- Subcutaneous hemorrhage of legs
- Lungs filled with fluid and blood
- Tracheitis and airsacculitis
- Petechial hemorrhages on internal organs

With or without the symptoms listed above, an unusual spike in mortality would also classify a flock as exposed or infected with HPAI. Unusual mortality is defined as:

- Commercial broilers: exceeding 4 per 1,000 for 2 consecutive days
- Commercial layers: 4x normal daily mortality for 2 consecutive days OR 5% drop in egg production over 3 days
- Commercial turkeys: exceeding 2 per 1,000 per day
- Backyard flocks: any sudden or significant mortality or drop in egg production

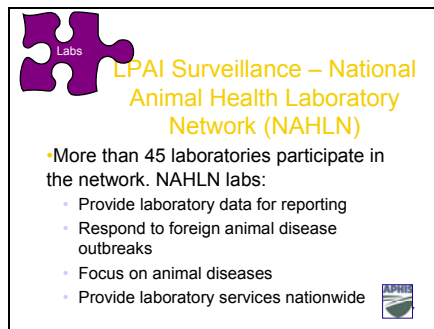
Diagnostic Testing in Poultry

- Rapid screening test: RRT-PCR
 - Identifies H5 or H7 viruses
 - Available within 4-7 hours
 - Confirmation by National Veterinary Services Laboratory (NVSL)
- Confirmatory testing: viral isolation
 - Genetic sequencing
 - Pathogenicity test
 - Available within 5-10 days of receipt

The preferred screening test for avian influenza is real-time reverse transcriptase polymerase chain reaction (RRT-PCR). This identifies H5 and H7 subtypes of the virus. It can be conducted by within 4 to 7 hours after receipt at the USDA-approved labs that make up the National Animal Health Laboratory Network (NAHLN). See the accompanying list of NAHLN labs in each state, and the pathogens they are capable of testing.

If there is any positive RRT-PCR test in one of these labs, a specimen is then forwarded to the National Veterinary Services Laboratory (NVSL) in Ames, Iowa, for replication of the RRT-PCR test and additional confirmatory testing.

Confirmatory testing involves isolation of the virus, along with genetic sequencing of the virus and pathogenicity testing. Results from confirmatory tests can be expected within 5-10 days of receipt. Note that because of the delay in getting confirmatory test results, response activities proceed on presumptive positive HPAI. Presumptive H5 or H7 diagnosis is based on clinical signs and positive RRT-PCR test.



Our next surveillance stream would be from laboratories.

The National Animal Health Laboratory Network (NAHLN) was created through the cooperation of USDA's Cooperative State Research, Education, and Extension Service; APHIS; and the American Association of Veterinary Laboratory Diagnosticians.

46 laboratories participate in the network; currently, 34 States are approved by USDA to perform AI diagnostics.

The NAHLN coordinates the veterinary diagnostic laboratory capacity of State animal health laboratories and their extensive infrastructure – facilities, equipment, and professional expertise. Those labs:

- provide accessible, timely, accurate, and consistent animal disease laboratory services nationwide;
- provide laboratory data to meet epidemiological and disease reporting needs;
- respond to foreign animal disease outbreaks or other adverse animal health events (including bioterrorism events); and,
- focus on diseases of both livestock (including exotic, zoonotic, and emerging diseases), and non-livestock animals.

Presumptive Positive in Poultry

- Sudden and significant increase in mortality
 - With clinical signs - or -
 - Post mortem lesions - and -
 - Decrease in egg production
- Positive RRT-PCR for H5 or H7
 - From NVSL, NAHLN, or other USDA-approved lab

Although viral isolation is the definitive test for confirming a positive H5 or H7 diagnosis, presumptive positive diagnosis is based on the following criteria:

A sudden and significant increase in mortality in a poultry flock, market, zoo collection, or wild bird population with corresponding clinical signs or post mortem lesions and a sudden and significant drop in egg production in a poultry flock

OR

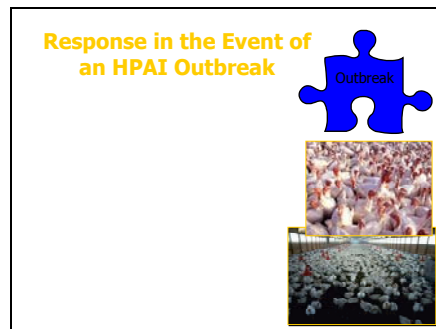
Report by the National Veterinary Services Laboratory or a National Animal Health Laboratory Network lab, or other USDA-approved lab that is positive on the RRT-PCR and H5 or H7 assay.

Reporting HPAI in Poultry

- Reporting varies by state
 - Industry
 - Backyard flocks
 - H5 or H7 LPAI
- Presumptive positive cases reported to USDA or DOI will be immediately reported to:
 - OIE (World Organization for Animal Health)
 - Trade partners
 - Other Federal agencies
 - States
 - Industry

Participation in USDA sponsored testing and reporting programs for avian influenza is voluntary for the states. States may require or request reporting of clinical symptoms and/or laboratory test results for both industry and backyard bird owners. The USDA works closely with the poultry industry in 21 states to facilitate reporting and containment of avian influenza among poultry flocks, and the other states have their own monitoring programs in place. The USDA is also monitoring H5 and H7 strains of low-pathogenic avian influenza.

Presumptive positive cases reported to the USDA or to Department of Interior agencies will be immediately reported to the OIE, trade partners, other federal agencies, states, and industry. This may include cases in breeder and commercial poultry flocks, domestic waterfowl and upland game birds, backyard flocks, live bird markets, and wild birds. Response measures would be initiated prior to receipt of confirmatory results from NVSL.



The final surveillance stream only occurs in the event of an outbreak. Surveillance activities are conducted in a zone around the affected premises, as well as hierarchical buffer zones around the affected zone.

Responding to Influenza among Poultry

- Response begins with presumptive positive or positive result on HPAI screening test
- Coordination between USDA, DOI, HHS, states, industry, tribes
- National HPAI Response Plan goals:
 1. Prevent contact between virus and susceptible animals
 2. Stop virus production in infected animals
 3. Increase disease resistance of susceptible animals through strategic vaccination

The responsibilities during a response to the occurrence of HPAI among poultry are described in the National Response Plan. The plan outlines the duties and necessary coordination between USDA, DOI, HHS, states, industry, and tribes.

The National HPAI Response Plan includes three primary goals after the initial detection of HPAI in poultry.

1. First, to prevent contact between the virus and susceptible animals. This is accomplished primarily by quarantine and movement control, biosecurity, epidemiological investigation with risk assessment, tracing of bird and other animal movement, and surveillance. It may also include culling of birds at risk for HPAI exposure.
2. Second, to stop virus production in infected animals. This is accomplished through depopulation and disposal of infected or exposed birds (or other animals).
3. Finally, to increase disease resistance of susceptible animals, which is accomplished by strategic vaccination. Currently, there are 40 million doses available for birds (USDA), and 30 million more planned.

Responding to Influenza among Poultry

- LPAI outbreak
 - Affected state takes the lead
 - Clean, disinfect, depopulate affected premises
 - USDA provides funding
 - Close attention to H5 and H7 strains
- HPAI outbreak
 - USDA takes the lead
 - Quarantine, clean, disinfect, and cull the infected and exposed bird population
 - CDC is notified
 - Bird owners compensated

If low pathogenic avian influenza (LPAI) is detected, USDA works with the affected state, which takes the lead. A series of measures are undertaken to clean, disinfect, and depopulate the affected premises in order to quickly contain and eradicate the disease. USDA provides funding and support personnel to states when LPAI is detected. Close attention is paid to H5 and H7 LPAI strains, because of their potential to mutate into HPAI.

If HPAI is detected, USDA takes the lead and will work with the affected state's Department of Agriculture and the affected premises to quarantine, clean, disinfect, and cull the infected and exposed bird population in order to quickly contain and eradicate the disease. When HPAI is detected, personnel from USDA's Animal and Plant Health Inspection Service (APHIS) are primary responders to control the virus because of the disease infectivity and high mortality rate among poultry. As part of the response, USDA will notify the U.S. Department of Health and Human Services' Centers for Disease Control. Additionally, USDA works with the affected premises to compensate owners for the loss of culled birds due to the disease outbreak.

Surveillance after HPAI Outbreak in Poultry

- Implemented within 48 hours of index case identification
- Major goals:
 - Define extent of outbreak
 - Detect new cases to facilitate rapid control measures
- Monitoring of flocks and wild birds on suspect and at-risk premises

The National HPAI Response Plan indicates that enhanced surveillance among poultry should begin no later than 48 hours after the identification of an index case. The goals of such surveillance are “to define the extent of the outbreak, including disease-free zones, and quickly detect new cases to facilitate implementation of rapid control and eradication measures.”

Surveillance will be conducted on suspect premises (birds under investigation for reported clinical signs, but no apparent epidemiologic link to infected premises or known contact premises) and at-risk premises (areas in a buffer surveillance zone that have susceptible animals, but no report of clinical signs). This surveillance includes laboratory testing of susceptible species and onsite inspections of the premises. It will also include slaughter surveillance, serological surveys, and investigation of reports of suspect disease.

References

- USDA National HPAI Response Plan, Aug 2006, http://www.aphis.usda.gov/newsroom/hot_issues/avian_influenza/contents/printable_version/DraftSummaryNationalHPAIresponseplan08-31-06.pdf
- An early detection system for highly pathogenic H5N1 avian influenza in wild migratory birds, U.S. Interagency Strategic Plan, March 2006, http://www.doi.gov/issues/birdflu_strategicplan.pdf
- Morgan, A. Avian influenza: an agricultural perspective. *J Infect Diseases*. 2006;194(Suppl 2):S139-S146

References

- USDA'S Role in the Implementation Plan for the National Strategy for Pandemic Influenza, May 6, 2006. http://www.usda.gov/documents/AI_Fact_Sheet_Implementation_Plan.pdf
- USDA Avian Flu Brochure <http://www.usda.gov/documents/AvianFluBrochure.pdf>
- US Department of the Interior, Issues of Interest: Avian Influenza (Bird Flu). <http://www.doi.gov/issues/avianflu.html>
- WHO Case Definitions: http://www.who.int/csr/disease/avian_influenza/guidelines/case_definition2006_08_29/en/print.html

Module 2

Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry Outbreak

Presentation Handouts

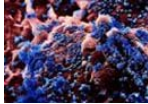
Exercises

Background Information

Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry Outbreak

Presentation Handouts

Case Management of Suspect
Influenza A (H5N1) Infection
in Humans



1

In this session we will talk about case management of suspect human avian influenza H5N1 infection.

Learning Objectives

- Recognize clinical features of H5N1 in humans
- Treatment of cases
- Public health action

2

We will focus on background information on clinical features avian influenza infection H5N1 in humans, treatment of suspect and confirmed cases, as well as public health actions that should be taken following the identification of a suspect or confirmed case.

Clinical Features

First let's look at the clinical features of influenza.

General Information		
	Human influenza	Avian influenza
Affected Age Groups	• All ages affected • Highest attack rate in children < 5 years • Most complications in elderly >60 years	• Children < 5 years • Healthy young adults • Adolescents
Estimated Incubation Period	• Mean: 2 days • Range: 1 – 3 days	• Mean: 2 – 3 days • Range: 2 – 8 days

Human influenza virus can infect anyone of any age group, but generally has the most impact on those who are very young or very old. Attack rates tend to be higher in young children under the age of 5, and the elderly over age 60 are especially vulnerable to complications. The current avian influenza H5N1 also affects children under the age of 5. However, healthy young adults and adolescents are frequently affected by H5N1 infection and complications. A WHO review found that 90% of H5N1 cases occurring in humans in 2003-2006 occurred in people less than 40 years of age.

The time from exposure to the virus to onset of illness, or the incubation period, for seasonally occurring human influenza virus is generally 1 to 3 days with a mean of 2 days. For avian influenza H5N1, the incubation period is estimated to be a little longer; it can range from 2 to 8 days with a mean of 2-3 days. This longer period may be due in part to the difficulty of estimating when exposure to the avian virus occurred.

Signs and Symptoms	
Avian Influenza (H5N1)	
Type of infection	Lower respiratory
Symptoms	Fever, Cough, Headache
	Shortness of breath, difficulty breathing
Hospitalized Patients	Diarrhea
	Pneumonia
	Hypoxia requiring oxygen
	Severe respiratory distress, Acute Respiratory Distress Syndrome (ARDS)

It can be difficult to tell if a patient with a respiratory illness has influenza because the signs and symptoms are non-specific. However, here are some of the signs and symptoms to look out for if you do suspect avian influenza.

Avian influenza leads to a lower respiratory infection with variable upper respiratory involvement. Initial symptoms are similar to human influenza. These include fever, headache, cough, sore throat. Symptoms of a lower respiratory infection appear early in course of the illness. About five days after symptoms appear, patients may begin to have shortness of breath and difficulty breathing, which can lead to hospitalization and respiratory distress. Many patients exhibit hypoxia and require oxygen. By this time, sputum production may occur and may contain blood. Recovery is typically longer than that of human influenza infections.

Laboratory Findings
Commonly associated with avian influenza H5N1:
– Drop in white blood cell count (lymphocytes)
– Mild to moderate drop in blood platelet count
– Increased aminotransferases (liver enzymes)

In addition to signs and symptoms, a few laboratory findings have been commonly associated with avian influenza H5N1 infection. These include:

- The most important finding has been an observed drop in the white blood cell count, especially lymphocytes
- A mild to moderate drop in the blood platelet count
- An increase in aminotransferases, or liver enzymes, is also common

Epidemiological Context

7

Of course clinical features alone are not cause enough to suspect avian influenza. The epidemiological context – meaning the potential exposures to a source of avian influenza infection – must be considered. There are a number of possible sources of infection.

Exposure to Avian Influenza

1. Infected poultry, particularly contact with respiratory secretions
2. Infected wild or pet birds
3. Other infected animals (e.g., pigs, cats)
4. Wild bird feces, poultry manure and litter containing high concentrations of virus
5. Contaminated surfaces



8

More detailed information is provided in your background slides, but briefly, exposure to avian influenza includes the following:

- infected poultry, particularly contact with respiratory secretions
- infected wild or pet birds
- other infected animals (e.g., pigs, cats)
- wild bird feces, poultry manure and litter containing high concentrations of virus
- contaminated surfaces

Exposures Continued

6. Under- or uncooked poultry meat or eggs from infected birds
7. Contaminated vehicles, equipment, clothing, and footwear at affected sites, such as poultry farms with outbreaks
8. Contaminated air space (e.g., a barn, hen-house, or the air space proximal to barn exhaust fans)
9. Bodies of water with infected bird carcasses
10. Close contact with (within 3 feet of) confirmed cases

Cultural context can produce unique exposures

9

- under- or uncooked poultry meat or eggs from infected birds
- contaminated vehicles, equipment, clothing, and footwear at affected sites, such as poultry farms with outbreaks
- contaminated air space (e.g., a barn, hen-house, or the air space proximal to barn exhaust fans)
- bodies of water with infected bird carcasses
- close contact with (within 3 feet of) confirmed cases

Note that local practices can produce unique exposures depending on the cultural context – for example, cock fighting, food exposures such as duck-blood pudding, or bird hunting.

Specimen Testing

10

Next we'll move briefly into clinical specimen testing.

Clinical Specimens for Testing Influenza A (H5N1)

- Lower Respiratory Tract*
 - Bronchoalveolar lavage
 - Tracheal aspirate
 - Pleural fluid tap
 - Sputum
 - Upper Respiratory Tract
 - Nasopharyngeal swab/aspirate
 - oropharyngeal swabs*
 - Nasal Swab
- * Preferred specimens

Tests available in your public health laboratory and preferred testing methods should help guide you in providing recommendations to healthcare providers on which clinical specimens to collect.

Lower respiratory tract specimens are the preferred specimens for testing as they may have the high yield for avian influenza H5N1 detection. Bronchoalveolar lavage, tracheal aspirate, pleural fluid tap, and sputum may be collected. Oropharyngeal swabs can be used for diagnosing H5N1 within 1 to 2 weeks of infection.

Upper respiratory specimens may have a lower yield. If only upper respiratory specimens can be obtained, throat swabs are better than nasal swabs. From the upper respiratory tract, nasopharyngeal wash/aspirate and nasal, nasopharyngeal, or oropharyngeal swabs may be collected.

Clinical Specimens for Testing

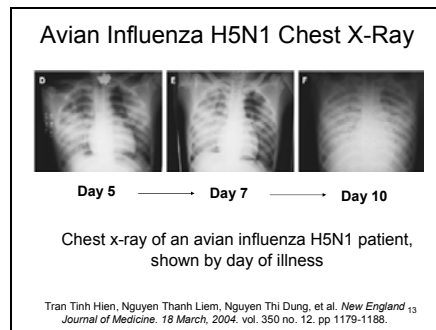
- Serology
 - Acute and convalescent serum specimens
 - Acute collected within 1 week of symptom onset
 - Convalescent collected 2-4 weeks after symptom onset
 - Other infections or concurrent illness
- Specimens should be collected within 3 days of symptom onset
- Collect all possible specimens, serial collection

12

In addition to respiratory samples, blood should be collected for acute and convalescent serological testing. Acute serum should be collected within one week of symptom onset while convalescent serum should be collected 2-4 weeks after symptom onset. Serologies can also be used to test for other infections or concurrent illnesses.

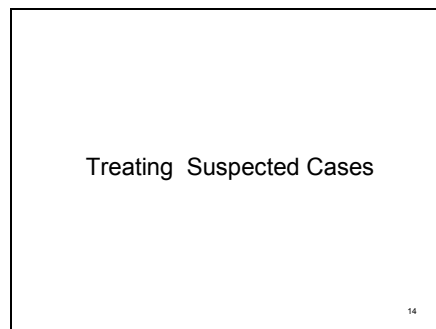
All specimens, with the exception of convalescent serum, should be collected as soon as possible after symptom onset but it is best for testing purposes to collect within 3 days of symptoms onset. It is also better to collect too many specimens than not enough. Whenever possible, collect all possible specimens including upper respiratory, lower respiratory, and serum. Serial specimen collection over several days is also recommended to improve the ability to diagnose avian influenza H5N1.

Note for facilitators: *These recommendations may change if human-to-human transmission becomes common. Please determine the most up to date guidelines at the time of training.*



The final type of testing that we want to review is Imaging. Imaging is a recommended testing procedure because X-ray changes are common in the lungs of avian influenza H5N1 patients and can indicate the presence of pneumonia. This pneumonia tends to rapidly progress to respiratory distress and subsequent respiratory failure, and cases may die in spite of being ventilated.

This excerpt from a published article illustrates the progression of pneumonia in a hospitalized patient with avian influenza H5N1 infection. You can see the lung infiltrates worsen and become more dense from day 5 to day 10.



Let's move on to discuss treatments for suspected cases.

Treatment Options

- Antivirals
- Antibiotics
- Supportive care



15

Antivirals, antibiotics, and supportive care are treatment options for patients with avian influenza. Antibiotics may be used to treat secondary bacterial infections, but do not work against viruses such as influenza. Let's take a moment to discuss antivirals.

Neuraminidase Inhibitor

- Two drugs available
 - Oseltamivir (Tamiflu®) and Zanamivir (Relenza®)
 - Should be given as soon as possible
 - Effective for treatment and prevention
 - Used for seasonal and avian



The two neuraminidase inhibitor drugs currently available are Oseltamivir, with the trade name Tamiflu, and Zanamivir, with the trade name Relenza. You should not wait for laboratory diagnosis before beginning treatment; all patients should begin treatment as soon as possible. There is some suggestion that antivirals given within 48 hours of symptom onset may improve survival. Antivirals can also be given to prevent disease from developing in those who have been exposed to the virus. These drugs are used in the treatment for seasonal and avian influenza.

Other Treatments?

- **Amantadine and Rimantadine**
 - H5N1 resistant in some isolates
 - Not as effective as neuraminidase inhibitors
- **Corticosteroids**
 - Low dose for sepsis
 - Unclear if high dose useful
 - Risk of side effects
- **Ribavirin**
 - Ineffective against influenza viruses

17

For human influenza infections, Amantadine and Rimantadine are also used for treatment. However, avian influenza H5N1 has been shown to be resistant to these drugs in some patients. Furthermore, the drugs are not as effective as the neuraminidase inhibitors. However, if the first choice of drugs is not available and there is evidence that the virus might be susceptible to Amantadine or Rimantadine, these can be administered.

However, do not use Ribavirin - it is not effective against influenza viruses.

Corticosteroids have been used in low doses to treat sepsis, or a bacterial infection in the blood. It is unclear if a high dose is useful for treatment of avian influenza H5N1 infections, and there is a risk of side effects. They are generally not recommended for H5N1 influenza treatment.

Public Health Action

18

As responders, a primary goal will be taking action to protect the health of the public.

Response Overview

1. Collect Case Information
 - Classify case according to case definition for surveillance
2. Facilitate specimen collection and laboratory testing
3. Information on avian influenza illness
4. Infection control measures in the home
5. Active case follow up
6. Identify close contacts and recommend chemoprophylaxis

19

Many of the recommendations in this presentation have been adapted from CDC guidelines designed for conducting surveillance and investigation activities to identify and control human illnesses associated with avian influenza outbreaks among animals.

Listed on this slide are a number of items you will need to undertake in the days following the identification of a suspected avian influenza H5N1 case. We will discuss these individually.

1. Collect case information from patient using a standardized form
 - Classify cases according to case definition for public health surveillance purposes
2. Facilitate specimen collection and laboratory testing
3. Provide patient and household contacts information on avian influenza illness
4. Provide patient and household contacts information on infection control measures in the home
5. Conduct active case follow up
6. Identify close contacts and recommend chemoprophylaxis

By no means is this list exhaustive. There are many other tasks you will need to undertake that will not be reviewed in this presentation. However these actions warrant mention in our discussion of case management.

Case Definitions

- Confirmed
- Suspect
- Report under investigation
- Non-case

- Refine for outbreaks

20

First you will collect information from patients on a field report form. Once you have collected this information, it is important to classify patients according to a standardized case definition. Guidelines from CDC have four case definitions for avian influenza H5N1. They are confirmed, suspect, report under investigation, and non-case. You can find the details on these definitions in your course materials for this module.

The case definitions given are for public health surveillance, and are useful for determining who gets laboratory testing. If you move into an outbreak situation, be sure to refine your case definitions.

The WHO case definitions you learned about earlier are designed for classifying cases for reporting purposes.

Active Follow Up

- Reasons for follow up
 - Specimens for testing
 - Timely notification of results
 - Monitor delivery of antiviral therapy
 - Secure antivirals if shortage
 - Note unusual clinical presentations or complications
- Follow up by telephone
 - Patient
 - Healthcare provider (when available)
 - Surrogate (e.g. spouse)



21

In addition to your initial interaction with the patient to collect information for your standardized form, it is important to actively follow up on the progress of the patient.

You will want to ensure appropriate specimens were collected for laboratory testing, and that there was timely notification of results. You will also want to carefully monitor delivery of antiviral therapy, secure antivirals if shortage ensues, and note any unusual clinical presentations or complications that may have arisen after your initial contact.

Since you will want to limit contact with the patient, follow up may be conducted by telephone with the patient, healthcare provider (when available), or a surrogate such as a spouse.

Identifying Close Contacts

- List of contacts from patient's case report form
- Close contact = Within 3 feet
 - Sharing utensils, close conversation, direct contact
- Follow Up
 - Characterize exposure
 - Identify signs and symptoms
- Those with symptoms treated as potential avian influenza case

22

From the patient's case report form, you should have a list of individuals who were in close contact (within 3 feet) with the patient, typically household members and co-workers. Examples of close contact include kissing or embracing, sharing eating or drinking utensils, close conversation, or any other direct physical contact between persons. Close contact does not include activities such as walking or sitting by a person briefly.

These individuals should be followed up to characterize their exposure and identify any signs and symptoms of avian influenza. Those presenting with signs and symptoms should be treated as potential avian influenza H5N1 cases.

Recommendations to Contacts

No symptoms

- Receive current influenza vaccine
- PEP for close contacts of a confirmed avian influenza H5N1 case
 - Antiviral (neuraminidase inhibitor) and dosage information in Background section

23

Public health authorities should be consistent and clear in their recommendations and instructions to contacts.

Those close contacts not presenting with symptoms should receive the current human influenza vaccine if they have not already been vaccinated.

Close contacts of confirmed cases of avian influenza H5N1 should receive post-exposure prophylaxis. The background portion of this module has more information on antiviral therapy, specifically neuraminidase inhibitors, and dosages.

Instruction to Contacts

No symptoms (continued)

- Self monitor for 10 days after last exposure
 - Fever, respiratory symptoms, diarrhea, and/or conjunctivitis
 - Seek medical care if symptoms present
 - Notify public health authorities
- Follow infection control measures in the home

24

Contacts should also be advised to self monitor for 10 days after their last exposure to the patient. Symptoms to look for include fever, respiratory symptoms, diarrhea and/or conjunctivitis. Contacts should seek medical care if any of these symptoms present and should also notify public health authorities. Public health authorities should provide information to contacts regarding infection control measures in the home.

Summary

- For suspect cases, ask about recent exposure and contact with humans or animals that may have had avian influenza H5N1 infection
- Important appropriate clinical specimens need to be collected and tested
- Begin treatment with neuraminidase inhibitor immediately! Do not wait!
- Case management also means identifying contacts

25

In summary, there are several important points you should remember from this presentation:

It is important to find out if your patient has had any exposure or contact with humans or animals that may have had avian influenza H5N1 infection. Ask patients about recent exposure and contact with humans or animals that may have had avian influenza H5N1 infection. Clinical features of avian influenza H5N1 are non-specific so you should not suspect avian influenza H5N1 infection based on symptoms alone.

Diagnosis of avian influenza H5N1 requires laboratory confirmation so it is important that appropriate clinical specimens are collected and tested. Suspected cases of avian influenza H5N1 should be treated with a neuraminidase inhibitor immediately. You should not wait for results before beginning treatment.

Case management includes identifying close contacts and investigating these individuals for illness.

Breakout Groups

26

You will now break out into smaller groups to work on exercises concerning case and contact management. Refer to the detailed slides in your course materials if you need further information on case management issues.

Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry Outbreak

Exercises

Exercise 2

Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry Outbreak

Part 1: Background information on clinical features and case management of suspected avian influenza H5N1 infection

Objectives:

- Identify clinical features of suspected avian influenza H5N1 infections
- Assess exposure to avian influenza H5N1
- Give recommendations to healthcare providers in the management of suspected avian influenza H5N1 patients

Instructions:

For this exercise, you will work with your group to complete a case study investigation. Each segment of case study information will be followed by a series of questions. Your facilitator or one person in your group should read the information aloud to group members. Then, work as a group to generate one answer for each question asked.

Time allotted: 1.5 hours

The Situation

It is May 16, 2006. You are working at the regional (6-county) public health department. H5N1 influenza has been discovered among poultry at a farm in a neighboring state, State X. Surveillance among poultry in the agricultural region of your state, Home State, including those in your own county, has been heightened. A sample of birds is being tested for influenza before slaughter, and increased tracheal sampling of birds on farms is taking place. Today, the local Wilson's Farm has reported a sudden die off among its flock to the state Department of Agriculture.

Question 1 – What action do you, as part of the public health workforce, take as a result of this situation?

Suggested answer – *It will be important for animal and public health agencies to coordinate. Public health workers should be actively working to identify those who may be exposed to the virus and to educate them about signs and symptoms, use of appropriate personal protective equipment, and hygiene. Public health*

workers may need to visit affected farm and nearby farms in coordination with Agriculture, and distribute educational messages in print and through the media. Communications with the public should be conducted in conjunction with the agriculture department. Let the family and farm workers know that they should contact the health department if they begin experiencing symptoms. The health department may wish to establish active surveillance via telephone for these individuals. Area physicians should also be reminded of the potential for human illness and the importance of reporting any suspect illnesses. Public health workers may also want to:

- *Conduct ongoing surveillance for human illness linked to affected premises. The Department of Agriculture can facilitate contact with poultry workers from the affected farm.*
- *Ensure timely reporting of any suspect, probable, or confirmed human cases and reporting of any control measures put in place, through the normal reporting channels (i.e., from local public health to state authority to CDC).*
- *Characterize human seasonal influenza strains currently circulating in or near the affected area(s) to differentiate avian and seasonal influenza (only appropriate if it is flu season).*
- *Notify any other states that might be receiving people linked to the poultry outbreak (such as workers involved in poultry control and eradication activities who are returning to their home states).*

Additionally, this would be a good time to establish communications with counterparts in the state's department of agriculture (if not already done).

Questions for Discussion – In your state, region, or local area are there established channels of communication between the Departments of Public Health and Agriculture? Is there a protocol in place for sharing information and coordinating the workload between agencies in the event that a highly pathogenic strain of influenza is detected among poultry?

Facilitator – Encourage participants to share about what they know of these issues in their jurisdiction. Discussion may bring out whether or not there are clearly delineated boundaries for each agency, and whether members of one agency understand the responsibilities of the other.

A Patient

You are in your office when you receive a phone call from Dr. Garvill at Community Hospital. A 39-year old female named Maya Thomas has just been admitted. She first visited her primary care physician on May 12. Her symptoms began on May 11 and included a fever (38 C/100.4 F), nausea, and cough. Her white blood cell count was low as well as her lymphocyte count. The platelet count was normal. Amoxicillin was prescribed.

Question 2 – Based on this information, what illness would you suspect this patient has?

***Suggested answer** – The patient could have a number of illnesses, but viral respiratory infection is likely.*

Additional Background

Dr. Garvill continues. He tells you on May 15, Maya went back to her primary care physician as she began to have shortness of breath. Her physician recommended she be admitted to Community Hospital. A chest x-ray was performed. She had patchy infiltration in the lower region of both of her lungs. Treatment with ceftazidime and azithromycin was given.

Question 3 – Do you think the patient has influenza (human or avian)?

***Suggested answer** – Although she is now presenting with respiratory symptoms and other symptoms of influenza, you would probably not suspect the patient has avian influenza infection. The symptoms are not specific for influenza (human or avian) and may represent other respiratory illnesses.*

Maya's Current Condition

Shortly before Dr. Garvill contacted you, he checked Maya's stats again. She had a fever of 102.9F / 39.4C and a high respiratory rate of 44 breaths per minute. Her heart rate was also high at 140 beats per minute. Her blood pressure was 110/80 mm Hg. A follow up chest x-ray shows diffuse bilateral infiltrates, and her arterial blood oxygen is 48 mmHg. Dr. Garvill decided to intubate her. Laboratory tests on her blood found a drop in lymphocyte count. Platelet count was normal. The clinical profile indicated she was developing acute respiratory distress syndrome. Dr. Garvill gave her imipenem, azithromycin, and doxycycline. He thinks she may have had poultry exposure, but this history was not taken.

Question 4 – To date, do any symptoms indicate human influenza infection? Which symptoms might indicate avian influenza H5N1 infection?

Suggested answer –

- *Symptoms that might indicate seasonal influenza: fever, cough*
- *Symptoms that might indicate avian influenza: fever, diarrhea, vomiting, and nausea. Maya also has respiratory symptoms of cough and shortness of breath. Her respiratory rate is high, her x-rays indicate respiratory distress, and her arterial blood oxygen level is low.*

Laboratory profile: drop in lymphocyte count also common in avian influenza infection

Question 5 – Dr. Garvill asks you, “Could this be avian influenza H5N1?” What is your reply? Why or why not? What other information would you like to know?

Suggested answer – *Based on her signs and symptoms, and the possibility that H5N1 influenza could have spread from State X, it cannot be ruled out. However, you need to know if she had any potential exposures within 10 days of her symptom onset. Other information you may want to know includes, “Was she in any area with known or suspected H5N1 activity?” “What is her occupation?” and “Did she have contact with birds?” and “Did she travel before she became sick?”*

H5N1 Activity

The discovery of avian influenza H5N1 in poultry in State X has been in the headlines for the past couple of days. After getting off the phone with Dr. Garvill, you call the State Department of Agriculture (State Ag) contact for updated information. You are told that a fax notice is going to be sent to all health department offices shortly. Soon, State Ag faxes you the following:

STATE DEPARTMENT OF AGRICULTURE HIGHLY PATHOGENIC AVIAN INFLUENZA ALERT

UPDATE AS OF 12:00PM MAY 16

In mid-April poultry die-offs were reported in 3 poultry farms in State X. On April 26th, laboratory testing confirmed H5N1 influenza among poultry at two of these farms. Expanded testing and surveillance detected the virus at low levels among 2 other poultry houses with apparently healthy flocks. Due to these events, influenza surveillance among poultry in Home State has been heightened. Events in Home State are as follows:

- May 3: Precautionary influenza testing begun among poultry farms
- May 8: First round of tests indicate no influenza activity among area poultry farms
- May 10: State Wildlife contacted to coordinate testing of wild birds
- May 12: Poultry die-off reported, Wilson Farm. Testing initiated again at Wilson Farm and surrounding poultry houses.
- May 14: Active surveillance for sick poultry uncovers no new die offs
Influenza activity has been observed among wild birds (for more information, contact State Wildlife, 302-5897).
- May 16: (Today) Testing results from Wilson Farm inconclusive, testing initiated again. Surrounding poultry houses test negative. To date, no highly pathogenic avian influenza has been found.

For technical questions regarding this alert, call 357-2236 and ask for Arch Green. For interviews or public information, ask for Lydia Yang.

Question 6 – How is this information helpful for you concerning Maya, and what is your index of suspicion for human infection with avian influenza?

Suggested answer – Since there is confirmed avian influenza H5N1 among State X's poultry, you should have some suspicion that a patient with a severe respiratory illness such as pneumonia may have avian influenza H5N1. In addition, a sudden die off in poultry in a farm in your county is suspicious although it is not definitive. However, it is critical to find out if Maya had any potential exposures to poultry, and it is not likely she would be suspected of having avian influenza until a poultry exposure is confirmed.

If you have not already, you should establish contact with health departments in State X and CDC, so that you can communicate with each other immediately if it appears that transmission from poultry to humans has occurred.

Finally, one would hope in this scenario that the health department and other responding agencies have been on high alert since H5N1 was first detected in State X, and have already taken additional action for preparedness.

Question 7 – What Federal, State or local agencies should be involved in this investigation, and what are their responsibilities?

Suggested answer – The exact roles of state and local agencies will vary by jurisdiction. Some examples are given below.

Federal:

The USDA will provide immediate response and investigation in the event of suspected highly pathogenic influenza among US livestock. Personnel from the local office would be involved from the beginning to participate in the investigation in coordination with the state. USDA will advise, coordinate, or lead an investigation to trace infected animals to the source; issue guidelines, advice, and manpower to State agencies; and coordinate with State agencies to provide a contact for local farmers and veterinarians if avian influenza is suspected.

The CDC will assist states in conducting surveillance for human cases. It will educate appropriate persons and the public on the use of preventive equipment and procedures. The CDC will also investigate and provide laboratory confirmation for humans exposed to animal influenza and may supply antiviral medication through the Strategic National Stockpile.

State:

The state agriculture agency may conduct surveillance among agricultural animals in the state; assess the need and issue orders for quarantine and/or culling of animals; participate in tracing infection among the food supply to its source; answer questions, provide guidelines, and serve as a contact for local veterinarians. They will coordinate response and investigation activities together with USDA, and will lead the public information effort.

The state health department will likely have the responsibility to advise on the use of antivirals, and access the Strategic National Stockpile if needed. It will conduct

and coordinate enhanced surveillance for avian influenza among humans, particularly those exposed to affected animals; coordinate the provision of health services to those exposed to affected animals; communicate and coordinate with federal and local agencies; and communicate with the public.

Natural resources/wildlife agencies will conduct surveillance among wild birds, in coordination with and assistance from federal agencies.

Local:

The health department will conduct surveillance for human cases in affected areas; work with educating area hospitals and physicians about signs, symptoms, and methods of reporting; provide health services to affected populations; and coordinate with State and Federal agencies as needed.

Other agencies that may be involved include veterinary agencies, agencies involved in emergency management, transportation agencies, state or university diagnostic laboratories, and hospitals. It may be helpful to form a joint incident command system (ICS) to coordinate the response among agencies.

Exposure

You ask Dr. Garvill if he knows anything more about Maya, such as where she lives, her occupation, and if any household contacts are ill. Fortunately, Dr. Garvill knew to ask these questions because of the media attention surrounding the recent discovery of H5N1 in the neighboring state. Due to Maya's condition, Dr. Garvill spoke with Maya's husband Daniel.

Maya and Daniel live in a rural area of the county. They have two children living at home, ages 2 and 7. No one else in the family is ill. Maya is employed at Wilson's Farm where she is a farm hand manager. Daniel noted that a few days before Maya became ill, she had come home late one night. She had worked overtime- because the farm was seeing more deaths than normal in the flock- assisting in separating sick and dead poultry from apparently healthy poultry.

Question 8 – Do you think Maya is at risk for avian influenza H5N1 infection? If yes, what kind of exposures could she have had?

Suggested answer – *It is reasonable to think that the patient is at risk for avian influenza H5N1 infection, pending lab results from the farm. Maya could have been exposed to poultry, poultry blood, or feces if a lapse in biosecurity occurred on the farm.*

Question 9 – What clinical and epidemiological evidence do you have that Maya may have avian influenza H5N1 infection? What are the differential diagnoses?

Suggested answer – *The patient has a number of symptoms that indicate avian influenza H5N1 infection: fever, nausea, cough, shortness of breath, high respiratory rate, and patchy infiltrates in the lungs consistent with respiratory distress, and low arterial blood oxygen. You know that this is not enough evidence to confirm H5N1 infection because the symptoms can also be caused by other illness. However, you know that she may have been exposed to sick or dead poultry through her job. Given all of this information, you suspect avian influenza infection H5N1. Whether the birds at Wilson's Farm have H5N1 is unknown, but H5N1 activity has been confirmed in a neighboring state.*

Differential diagnoses could include seasonal influenza, bacterial pneumonia, respiratory distress due to primary cardiac problems, ARDS, and other viral pneumonias.

Question 10 – Would you recommend testing Maya for avian influenza H5N1? Why or why not? If yes, what specimens would you advise Dr. Garvill collect?

Suggested answer – *Although Maya has received a number of antibiotics, testing for avian influenza H5N1 is still possible as viruses are not affected by antibiotics. If possible, collection of oropharyngeal swabs or any specimens from the lower respiratory tract (bronchoalveolar lavage, tracheal aspirate, pleural fluid tap or sputum) is preferred as these have the highest yield.*

Question 11 – Would you recommend treating Maya for avian influenza H5N1 infection at this point? Why or why not? If you would not recommend treatment, what information would you want before you recommend treatment?

Suggested answer – *If you would not recommend treatment, you probably are waiting for laboratory confirmation on either the farm or Maya.*

You have assessed that Maya has symptoms compatible with avian influenza H5N1 and has had a possible exposure to H5N1. Although there is no laboratory confirmation of H5N1 in poultry in your area, H5N1 activity has been detected in a neighboring state. Therefore it is quite possible Wilson's Farm has H5N1 activity. Treatment with antivirals must be done as soon as possible after symptom onset and waiting for laboratory confirmation means a delay in treatment for Maya.

Weighing these two issues, it would be best for Maya to begin treatment with antivirals immediately, preferably the neuraminidase inhibitor oseltamivir. If this is not possible, zanamivir should be given. However, before beginning treatment with either drug, be sure to confirm her pregnancy and nursing status. Pregnant

and nursing females should not be given treatment with a neuraminidase inhibitor, but this should be weighed in light of her condition. For zanamivir, be sure Maya has no chronic respiratory conditions as this is a contraindication.

Community Hospital

Before hanging up with Dr. Garvill, you ask if Maya is in isolation. Dr. Garvill tells you that, although Maya is in a room by herself, she is not in isolation. Standard precautions (e.g. handwashing) are followed for all patients.

Question 12 – What additional recommendations would you offer Dr. Garvill for infection control measures in Community Hospital?

Suggested answer – Confirm with Dr. Garvill that Maya will be placed in isolation immediately. In addition, airborne/droplet (negative pressure room, N95 mask or more protective) precautions should be instituted as well as eye protection, and contact precaution (gloves and gown worn). Dedicated equipment should be used in caring for Maya. Finally, the room Maya has been in should be disinfected properly.

Case Study 1: Conclusion

Later in the day, you receive a phone call from your state Department of Agriculture counterpart. Results from Wilson's Farm confirm the poultry were infected with avian influenza H5N1.

Based on clinical features and information about exposure to birds, you were able to appropriately suspect Maya may have avian influenza H5N1 infection.

Part 2: Public Health Action

Objectives:

Minimize the risk of spread or further human illness associated with avian influenza H5N1 among poultry

Instructions

This exercise builds upon Case Study 1, focusing on the public health actions you will need to undertake while following up on your investigation of Maya Thomas. Although many people will need to take action to prevent the spread of avian influenza H5N1, this exercise will focus only on what public health practitioners need to do to protect human health.

Please have Part 1 of this exercise and CDC guidelines available for quick reference. Each segment of information will be followed by a series of questions. Your facilitator or one person in your group should read the information aloud to group members. Then, work as a group to generate one answer for each question asked.

Time allotted: 1.5 hours

The Afternoon

You hang up the phone with the state Department of Agriculture (State AG) and head straight to the offices of the regional health department director, Dr. Vaughn. You tell her what you know: 1) confirmed avian influenza H5N1 is in circulation in poultry at Wilson's Farm, and 2) the farm hand manager for Wilson's Farm, Maya, is in the hospital with symptoms compatible with avian influenza H5N1 infection. Dr. Vaughn and you begin to discuss the next steps that need to be taken.

Question 1 – According to the surveillance case definition for avian influenza H5N1, how would you classify Maya?

Suggested answer – *Maya would be a suspect case of avian influenza H5N1 because she meets the following criteria:*

Documented temperature >38 C (>100.4 F) and one of the following: cough, sore throat, and/or respiratory distress AND

One of the following exposures within 10 days of onset

- ***Direct contact with sick or dead domestic poultry***
- ***Direct contact with surfaces contaminated with poultry feces***

- *Consumption of raw or partially cooked poultry or poultry products*
- *Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection*
- *Work with live H5N1 influenza virus in a laboratory*

Laboratory test for H5N1 is pending, inadequate or unavailable

Question 2 – What public health actions do you think are “next steps”?

Suggested answer –

- Case follow up
 - *Complete case investigation form*
 - *Ensure that specimens are collected from Maya*
 - *Ensure that Maya is receiving treatment*
- Contact follow up
 - *Interview household contacts*
 - *Interview close contacts (w/in 3 feet)*
- Communication
 - *Notify state health department*
 - *Notify healthcare providers in jurisdiction*
 - *Provide literature to healthcare providers to pass to patients*
 - *Provide literature to contacts*
 - *Alert public through press release (with state AG officials)*
- Exposure Assessment at the Farm
 - *Identify staff who work at Wilson’s Farm and those who have been on the farm 3 days prior to signs and symptoms of illness in poultry*

Visiting Community Hospital

Dr. Vaughn has asked you to continue to follow up with Maya, and to also follow up with her household and close contacts. You ring Dr. Garvill and make arrangements to visit Maya and Dr. Garvill at the Hospital. Fortunately Maya’s husband Daniel is at the hospital so you make arrangements to talk with him as well. Dr. Garvill has been monitoring Daniel and he is not showing any symptoms at present.

You arrive at the hospital and have a quick chat with Dr. Garvill as you review Maya’s chart. Dr Garvill has had Maya moved to isolation, taken tracheal aspirate specimens, and forwarded them to the state public health laboratory for testing. In addition he was able to begin treatment with oseltamivir.

Question 3 – Why do you want to assess Maya’s household and close contacts for illness? How long should they be monitored for signs of illness?

Suggested answer – *You want to find out if any of them have any signs or symptoms of avian influenza and to characterize their exposure. If there is any evidence of a cluster of suspect avian influenza cases, you should be immediately concerned about the possibility that human-to-human transmission may have occurred. Human-to-human transmission is most likely to happen among close, frequent contacts, such as household members and children’s playmates. The faster you can determine health status of contacts, the faster you can work to contain the spread of avian influenza. Close contacts should be monitored for 10 days to evaluate whether symptoms of influenza develop.*

Household Contacts

You also get a quick update on Maya’s current status and learn that her condition continues to deteriorate. She is already on mechanical ventilation and her kidneys are beginning to fail. He is not sure she will make it through the evening.

You head over to Maya’s room and see Daniel outside the room, waiting for you. The two of you find a quiet seating area and you begin to ask questions about Maya’s household and close contacts.

There are only four individuals in the home: Daniel (40), Maya (39), Jacob (7), and Kayla (2). In the 10 days prior to her onset, Maya’s only travel was to work or home. Daniel did not know of any other close contact outside of home and work. She had weekend plans to visit friends but cancelled because she was not feeling well. Neither of the children is sick.

Question 4 – What recommendations would you make for post-exposure prophylaxis?

Suggested answer – *This is a difficult question to answer, but a good question to raise. Although the guidelines state post-exposure prophylaxis should be offered to household and close contacts of confirmed cases of avian influenza H5N1 infection, given the current circulation of HPAI in the poultry at Maya’s job and her present condition, it would be prudent to offer post-exposure prophylaxis to Maya’s family.*

Question 5 – If Maya were a confirmed case of avian influenza H5N1, would you recommend that her contacts be given the seasonal influenza vaccine?

Suggested answer – *There is a small possibility that dual infection with a human strain and avian strain of influenza could result in a reassortment of the influenza virus, creating a virus that could be easily transmitted from person to person leading to a pandemic. Thus, CDC recommends that contacts of confirmed cases, and those who are at high risk for HPAI H5N1, receive the seasonal vaccine. However, in this scenario, Maya is ill in May, when the seasonal strain of influenza is generally not circulating. Thus, the risk of seasonal influenza infection is almost zero, and there probably would not be a vaccine available to give contacts until the start of the next flu season.*

Question 6 – You provide Daniel with literature regarding infection control measures in the home and how to self-monitor for signs and symptoms of avian influenza H5N1. Why is it important that you (as a health department employee) provide the information to Daniel?

Suggested answer – *It is important to have up to date and consistent information provided to all contacts regarding proper infection control measures and how to self-monitor. Providing literature allows contacts to have the information at their fingertips around the clock. This also gives you the opportunity to answer any questions Daniel may have and to note any “frequently asked questions” from contacts that may need to be addressed in future literature. As an extra note, you should be sure that translations into languages appropriate for the local population, such as Spanish, are available if needed.*

Question 7 – What other close contacts should you follow up with?

Suggested answer – *You should follow up with Dr. Garvill and the hospital staff who cared for Maya, as well as her primary care physician and his staff to assess for potential exposure and symptoms of avian influenza H5N1.*

Tuesday Morning, May 17, 2006

You arrive at the office to learn Maya passed away during the evening. You contact Dr. Garvill and he informs you Maya went into multi-organ failure and died around 10:00 pm. You recommend autopsy specimens be collected for testing, and Maya's husband agrees to the autopsy. You inform the state health department of Maya's death and alert them to the fact that autopsy specimens are being taken and will need to be forwarded to the CDC.

You head into a morning debriefing which involves an inter-agency conference call. You update the group with the news of Maya's death and inform them of your findings from yesterday evening's meeting with Daniel. You also note your follow up of Maya's healthcare providers: two physicians and one nurse had close contact with Maya and all are symptom-free.

Question 8 – Why is it important to report avian influenza activity in humans to the state health department?

Suggested answer – *Various answers may be given but normal reporting chain should be followed (local public health to state public health to CDC) as the information provided to CDC will be shared with the World Health Organization (WHO). This will help determine the pandemic phase of avian influenza in the US.*

Wilson's Farm

At the debriefing you learn Wilson's Farm was quarantined yesterday, once it was discovered avian influenza H5N1 was circulating in the poultry. Local, state and federal officials were on the scene to help assist in culling and disinfecting activities. There are 14 employees at the farm not including Maya. Interviews were conducted yesterday for 11 of the individuals. All are asymptomatic. You are asked to help interview Lyle, one of the 3 pending interviews. Lyle is one of the farm hands who had been helping to remove the dead birds.

Discussion Questions –

- A. Who has the authority to close down a potentially infected farm?
- B. Do you think closing the farm was the appropriate action to take?
- C. What role, if any, does public health play in the closure of the facility?

Suggested answers –

- A. USDA and state officials*
- B. Yes. The decision may be easy to make from a health perspective. Although closing the farm has an economic impact on the owner and the community, it is necessary to contain the virus.*
- C. Public health officials are responsible for interviewing anyone potentially exposed to the disease. According to CDC guidelines, interviewing a symptomatic exposed person is considered a higher risk activity. Public health officials need to ensure that interviewers wear personal protective equipment and assist in assuring that proper disinfection procedures take place for anyone entering or exiting the farm. This risk can be avoided by conducting interviews over the phone. Public health will probably take a role in communicating to the public about the reasons for the closure of the farm, especially as the message should contain information on the level of risk to community members and how they can help prevent infection.*

Lyle

You are finally able to speak with Lyle in the late afternoon. While on the phone you notice he has a cough. You learn he was on holiday visiting his girlfriend's family in another state before returning to work on May 9. That day he stayed at the farm late to help dispose of the dead chicken carcasses. He continued to dispose of the dead poultry for a couple of days wearing a simple face mask and leather gloves. After Mr. Wilson reported the deaths to the State Ag on May 12, Lyle began to use appropriate personal protective equipment under the advice of the State Ag.

You ask Lyle about his cough. He tells you it started yesterday. He mentioned he had a headache as well but the symptoms are nothing since he has allergies. The reason he was not at work yesterday was because it was his day off.

Lyle lives with his girlfriend in a house near Wilson's Farm. His girlfriend is still at her parent's home. He has only socialized with his coworkers since returning from his holiday and has had no other close contacts.

Question 9 – According to the case definitions, what would Lyle be classified as? What recommendations would you give Lyle?

Suggested answer – *You should treat Lyle as a “report under investigation”. Since Lyle was exposed to dead birds without proper protective equipment from May 9-12 and has a cough (and had a headache), you should recommend he seek*

medical treatment immediately regardless of allergies. If possible, you should be sure to make his physician aware of his current situation and to take proper precautions while examining Lyle. He should also be advised to receive treatment with a neuraminidase inhibitor, preferably oseltamivir. (Since he is exhibiting symptoms, giving Lyle the treatment dose, as opposed to the post-exposure prophylaxis dose, is advisable.)

Question 10 – Lyle asks you what he should do with his work clothes and boots. Which guidelines should you reference to try and answer this question?

Suggested answer – *You can use any of the following to see if you can answer Lyle's question:*

- CDC Interim Guidance for Protection of Persons Involved in U.S. Avian Influenza Outbreak Disease Control and Eradication Activities, updated January 14, 2006 (<http://www.cdc.gov/flu/avian/professional/protect-guid.htm>)
- Occupational Safety and Health Administration (OSHA) document Avian Influenza Protecting Poultry Workers at Risk (<http://www.osha.gov/dts/shib/shib121304.html>)
- Animal and Plant Health Inspection Service (APHIS) Directive 6800.1, Ensuring the Protection of Employees Involved in Highly Pathogenic Influenza Control and Eradication Activities (May 10, 2006; http://www.aphis.usda.gov/library/directives/pdf/APHIS6800_1.pdf).

Wednesday Morning, May 18, 2006

You are in the morning debriefing when you learn Maya's initial results have come back positive for avian influenza H5N1. Specimens are being forwarded to CDC for confirmation.

Question 11 – Does this information have any bearing on Maya's case classification? What about your follow up of her close contacts?

Suggested answer – *Although Maya is deceased, she would be defined as a confirmed case of human avian influenza H5N1.*

If her close contacts had not already received post-exposure prophylaxis, they should begin immediately.

Question 12 – Based on the positive result, are there any additional steps that should be taken in your investigation or control measures?

Suggested answer – *Since there is currently no confirmed human avian influenza H5N1 in the US and our knowledge of the disease is still in its infancy, if a confirmed case were to be identified, it would be reasonable to proceed as if you had an outbreak. Contacts of the confirmed case should be carefully monitored for 10 days for potential human-to-human spread, **and** surveillance among those with exposure to affected poultry should remain meticulous, due to proven transmission from poultry to humans.*

Case Study Part 2 Conclusion

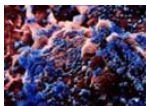
Of the 15 employees at Wilson's Farm, 12 had direct exposure to sick or dead birds. Five developed symptoms and had specimens collected; 3 were laboratory confirmed. One case ended in death. Lyle survived.

The outbreak of avian influenza H5N1 spread to other jurisdictions before it could be contained. By the end of the outbreak, 12 confirmed cases (laboratory and epidemiologically-linked) of avian influenza H5N1 transmitted from birds to humans were identified.

Case Management of Suspected Avian Influenza H5N1 Infection During a Poultry Outbreak

Background Information

Case Management of Suspect Influenza A (H5N1) Infection in Humans



Part 1: Background information on clinical features of avian influenza H5N1

1

In this session we will talk about case management of suspect human avian influenza H5N1 infection. This is Part 1 of a three part series. In this first part we will focus on background information on clinical features of avian influenza infection H5N1 in humans.

Learning Objectives

- Recognize clinical features of H5N1 influenza in humans
- Understand how information about the patient *before* onset of illness can help you suspect infection

2

By the end of Part 1, you should have a good understanding of the clinical features of avian influenza H5N1 infection in humans. You should also understand how additional information about the patient in the weeks before illness can help you suspect avian influenza H5N1 infection. Finally, you should know the types of treatment options available to people who are suspected to have avian influenza H5N1 infection.

Part 1 Session Outline

- Clinical features
- Epidemiological Context
 - Exposure

3

We will begin this session by discussing the clinical features of avian influenza H5N1 in humans. We will review signs and symptoms, laboratory findings, and complications. In addition, we will highlight differences between avian influenza H5N1 in humans and human influenza infections. Finally we will look at the epidemiological context of the patient by assessing potential exposure to avian influenza H5N1.

Illness Scenario

- Alex sick for three days
 - Fever
 - Headache
 - Cough
 - Short of breath
 - Watery diarrhea
- No one else sick
- Works at poultry farm and handles poultry

Question: Is avian influenza the most likely cause of Alex's symptoms?

4

Before we start, imagine that it is a normal working day for you at the local health department. You get an urgent phone call from Dr. Sarasin at a local hospital. She tells you about her 24 year old patient Alex who has been sick for the past three days. He has a high fever and complains of a headache. He has watery diarrhea that began two days ago. He started coughing yesterday, is short of breath, and is very tired. Dr. Sarasin decided to call you because she has heard about avian influenza from the news.

Dr. Sarasin tells you that no one in his family is sick. She also tells you Alex is works at a poultry farm where he handles the poultry.

Is avian influenza the most likely cause of Alex's symptoms?

Lecturer answer: Solicit answers from the audience. Answer is no – seasonal flu would be more likely.

Clinical Features

First let's learn about the clinical features of influenza.

General Information		
	Human influenza	Avian influenza
Affected Age Groups	• All ages affected • Highest attack rate in children < 5 years • Most complications in elderly >60 years	• Children < 5 years • Healthy young adults • Adolescents
Estimated Incubation Period	• Mean: 2 days • Range: 1 – 3 days	• Mean: 2 – 3 days • Range: 2 – 8 days

Human influenza virus can infect anyone of any age group, but generally has the most impact on those who are very young or very old. Attack rates tend to be higher in young children under the age of 5, and the elderly over age 60 are especially vulnerable to complications. The current avian influenza H5N1 also affects children under the age of 5. However, healthy young adults and adolescents are also frequently affected by H5N1 infection and complications. A WHO review found that 90% of H5N1 cases occurring in humans in 2003-2006 occurred in people less than 40 years of age.

The time from exposure to the virus to onset of illness, or the incubation period, for seasonally occurring human influenza virus is generally 1 to 3 days with a mean of 2 days. For avian influenza H5N1, the incubation period is estimated to be a little longer; it can range from 2 to 8 days with a mean of 2-3 days. This longer period may be due in part to the difficulty of estimating when exposure to the avian virus occurred.

Signs and Symptoms	
Avian Influenza (H5N1)	
Type of infection	Lower respiratory
Symptoms	Fever, Cough, Headache
	Shortness of breath, difficulty breathing
Hospitalized Patients	Diarrhea
	Pneumonia
	Hypoxia requiring oxygen
	Severe respiratory distress, Acute Respiratory Distress Syndrome (ARDS)

It can be difficult to tell if a patient with a respiratory illness has influenza because the signs and symptoms are non-specific. However, here are some of the signs and symptoms to look out for if you do suspect avian influenza.

Avian influenza leads to a lower respiratory infection with variable upper respiratory involvement. Initial symptoms are similar to human influenza. These include fever, headache, cough, sore throat. Symptoms of a lower respiratory infection appear early in course of the illness. About five days after symptoms appear, patients may begin to have shortness of breath and difficulty breathing, which can lead to hospitalization and respiratory distress. Many patients exhibit hypoxia and require oxygen. By this time, sputum production may occur and may contain blood. Recovery is typically longer than that of human influenza infections.

Laboratory Findings
Commonly associated with avian influenza H5N1:
– Drop in white blood cell count (lymphocytes)
– Mild to moderate drop in blood platelet count
– Increased aminotransferases (liver enzymes)

In addition to signs and symptoms, a few laboratory findings have been commonly associated with avian influenza H5N1 infection. These include:

- The most important finding has been an observed drop in the white blood cell count, especially lymphocytes
- A mild to moderate drop in the blood platelet count
- An increase in aminotransferases, or liver enzymes, is also common

Unusual Clinical Manifestations and Outcomes

- Knowledge of avian influenza H5N1 infection in humans is still evolving
- Unusual symptoms
 - Southern Vietnam – encephalitis and diarrhea
 - Disease can progress to ARDS

9

It is important to remember that our knowledge of avian influenza H5N1 infection in humans is still evolving. We have recently learned of a few unusual symptoms that have presented in patients.

In 2004, a 4-year-old boy that presented with diarrhea and encephalitis, including seizures and coma, was diagnosed with Influenza A H5N1 when the virus was isolated from cerebro-spinal fluid, rectal swabs, serum, and throat specimens.

Despite unusual clinical manifestations, the disease can progress to acute respiratory distress syndrome.

Complications

Seasonal Influenza

- Ear infection, sinusitis
- Bronchitis, bronchiolitis
- Pneumonia
 - viral or secondary bacterial
- Exacerbation of chronic conditions
- Muscle inflammation
- Neurologic Disease
 - Seizures
 - Brain inflammation
 - Reye's syndrome

Influenza A (H5N1) in Humans

- Almost all develop pneumonia
- Acute Respiratory Distress Syndrome (ARDS)
- Multiorgan failure
- Encephalitis
- Cytokine storms

10

Human influenza infection can lead to serious complications including: ear infection; sinusitis; bronchitis; bronchiolitis; pneumonia due to viral or secondary bacterial infections; exacerbation of chronic conditions such as asthma; muscle inflammation; and neurologic disease. Neurologic disease includes seizure, inflammation of the brain, and Reye's syndrome.

Almost all avian influenza cases develop pneumonia that seems to be viral rather than bacterial. Acute respiratory distress syndrome (or ARDS) was observed in patients in Thailand about 6 days after symptoms appeared. In Turkey, ARDS developed about 3 to 5 days after symptoms appeared. Multi-organ failure involving the kidneys and heart and encephalitis have also been reported.

Recently, researchers have discovered that H5N1 triggers extremely high levels of immune system inflammatory proteins, called cytokines. This contributes to the high mortality caused by H5N1 strains compared to seasonal influenza strains.

Alex

Question:

Do you think Alex has signs and symptoms of avian influenza H5N1? Why or why not?

11

Let's stop for a moment and think about Alex. After everything you have just heard, do you think Alex has **signs and symptoms** of avian influenza H5N1 infection? Why or why not?

Lecturer answer: Symptoms that may indicate avian influenza H5N1 do include high fever, headache, watery diarrhea, cough, and tiredness. However, these signs and symptoms are not specific for avian influenza H5N1, so we need more information to assess whether or not Alex may have avian influenza H5N1 infection.

Epidemiological Context

12

Now let's talk about epidemiological context and see how we can assess if someone has been potentially exposed to avian influenza H5N1.

Exposure to Avian Influenza

1. Infected poultry, particularly contact with respiratory secretions
2. Infected wild or pet birds
3. Other infected animals (e.g., pigs, cats)
4. Wild bird feces, poultry manure and litter containing high concentrations of virus
5. Contaminated surfaces



13

More detailed information is provided in your background slides, but briefly, exposure to avian influenza includes the following:

- infected poultry, particularly contact with respiratory secretions
- infected wild or pet birds
- other infected animals (e.g., pigs, cats)
- wild bird feces, poultry manure and litter containing high concentrations of virus
- contaminated surfaces

Exposures Continued

6. Under- or uncooked poultry meat or eggs from infected birds
7. Contaminated vehicles, equipment, clothing, and footwear at affected sites, such as poultry farms with outbreaks
8. Contaminated air space (e.g., a barn, hen-house, or the air space proximal to barn exhaust fans)
9. Bodies of water with infected bird carcasses
10. Close contact with (within 3 feet of) confirmed cases

Cultural context can produce unique exposures

14

- under- or uncooked poultry meat or eggs from infected birds
- contaminated vehicles, equipment, clothing, and footwear at affected sites, such as poultry farms with outbreaks
- contaminated air space (e.g., a barn, hen-house, or the air space proximal to barn exhaust fans)
- bodies of water with infected bird carcasses
- close contact with (within 3 feet of) confirmed cases

Note that local practices can produce unique exposures depending on the cultural context – for example, cock fighting, food exposures such as duck-blood pudding, or bird hunting.

Alex

Question:

Do you think Alex may have been exposed to avian influenza H5N1?

15

Do you think Alex may have been exposed to avian influenza H5N1?

Answer: Yes, Alex has had direct contact with poultry since his job requires him to handle birds.

Using All of The Information



16

Let us take a moment to stop and think about what we have discussed thus far. We know clinical features of avian influenza H5N1 are slightly different from human influenza, but it can still be difficult to differentiate between the two based on symptoms alone. Epidemiologic information can help confirm or alleviate our suspicions by shedding light on whether there were any potential exposures of our patients.

Alex's Situation

- 24 year old Alex sick for three days
 - Fever
 - Watery diarrhea
 - Headache
 - Cough
- No one else sick
- Alex works on poultry farm where he handles poultry

17

Let's revisit the information about Alex's scenario:

- Alex is 24 years old and has been sick for the past three days.
- He has a high fever and complains of a headache.
- He has watery diarrhea that began two days ago.
- He started coughing yesterday and is very tired.
- No one else in the family is sick.
- Alex works on a poultry farm where he handles poultry.
- We do not know if any poultry have died recently
- We do not know if any of Alex's co-workers are ill

Alex

Question:

Would you suspect avian influenza H5N1 infection? Why or why not?

18

Think about all that you know about what to look for in a person suspected of having avian influenza H5N1 infection, and the information that you have about Alex.

Would you suspect avian influenza H5N1 infection? Why or why not?

Facilitator Answer: Yes, you should suspect avian influenza H5N1. Alex has symptoms that are consistent with avian influenza H5N1 infection and has had direct contact with poultry.

Part 1 Summary

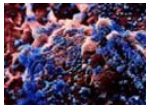
- Individuals with avian influenza H5N1 infection may have non-specific lower respiratory symptoms, or (rarely) none at all
- Ask about recent exposure and contact with humans or animals that may have had avian influenza H5N1 infection

19

In summary, there are two important points you should remember from this presentation:

- Individuals with avian influenza H5N1 infection may have non-specific lower respiratory symptoms, or (rarely) none at all. Once again, it is important to find out if your patient has had any exposure or contact with humans or animals that may have had avian influenza H5N1 infection.
- Ask patients about recent exposure and contact with humans or animals that may have had avian influenza H5N1 infection. Clinical features of avian influenza H5N1 are non-specific so you should not suspect avian influenza H5N1 infection based on symptoms alone.

Case Management of Suspect Human Avian Influenza H5N1 Infection



Part 2: Case Management of Suspected Avian Influenza H5N1 Cases

20

The next section will focus on case management of suspected avian influenza patients.

Public health authorities will not be expected to directly oversee management of patient care and treatment, but should be available to offer recommendations for laboratory testing and treatment. We will review current recommendations for public health authorities in working with healthcare providers.

Learning Objectives

- Testing available for diagnosing
 - Clinical specimens
- Current treatment options
- Infection control measures

21

By the end of this session, you should be familiar with :

- Testing available for diagnosing avian influenza H5N1 as well as clinical specimens for testing
- Current treatments options
- Infection control measures

Part 2 Session Overview

- Laboratory Testing
- Treating Suspected Patients
- Infection Control in the Healthcare Setting

22

Laboratory Testing

23

Let's begin by reviewing current recommendations for laboratory testing.

Diagnostics

- Avian influenza H5N1
 - Specimens for testing
- Influenza A
- Imaging



24

You should be familiar with laboratory tests available to diagnose avian influenza H5N1, influenza A, and the use of imaging in diagnosis. You should also be able to offer advice on clinical specimens that should be collected for testing avian influenza H5N1. As you are aware, healthcare providers need laboratory confirmation to diagnose a patient with avian influenza H5N1. This information is also helpful for public health authorities.

Avian Influenza H5N1

- **RT-PCR**
 - Detects viral RNA
 - Diagnose H5N1 in humans
 - BSL-2 conditions
 - Results within hours
- **Serologic Testing**
 - Rise in H5N1 specific antibodies
 - Antigen testing only in USDA-approved BSL-3 containment facility
- **Viral cultures**
 - Only in BSL-3 conditions with enhancements
 - Results in 2 – 10 days



25

Listed on this slide are the tests currently available for diagnosing avian influenza H5N1.

Real time polymerase chain reaction (RT-PCR) is a method that detects viral RNA. It is the preferred method for diagnosing avian influenza H5N1 in humans. All state public health laboratories, CDC, and several local public health laboratories have RT-PCR capabilities. These are the recommended sites for initial diagnosis as BSL-2 conditions are required for testing. Results can be obtained within hours.

Another method for avian influenza H5N1 testing is viral culture. However, this should NOT be attempted unless testing is done under BSL-3 conditions with enhancements. In addition, this process can take time with results in usually 2 to 10 days.

Finally, serologic testing can be performed although this is not optimal. Serologic testing should be considered if other diagnostic methods are unsuccessful (e.g. delays in respiratory specimen collection). To confirm H5N1 diagnosis, a rise in H5N1 specific antibody titers in paired sera are needed. Antigen detection is another method of testing but can only be performed in USDA-approved BSL-3 containment facilities.

Clinical Specimens for Testing Influenza A (H5N1)

- Lower Respiratory Tract*
 - Bronchoalveolar lavage
 - Tracheal aspirate
 - Pleural fluid tap
 - Sputum
 - Upper Respiratory Tract
 - Nasopharyngeal swab/aspirate
 - Nasopharyngeal or oropharyngeal swabs*
 - Nasal Swab
- * Preferred specimens

Tests available in your public health laboratory and preferred testing methods should help guide you in providing recommendations to healthcare providers on which clinical specimens to collect.

Lower respiratory tract specimens are the preferred specimens for testing as they may have the high yield for avian influenza H5N1 detection. Bronchoalveolar lavage, tracheal aspirate, pleural fluid tap, and sputum may be collected. Oropharyngeal swabs can be used for diagnosing H5N1 within 1 to 2 weeks of infection.

Upper respiratory specimens may have a lower yield. If only upper respiratory specimens can be obtained, throat swabs are better than nasal swabs. From the upper respiratory tract, nasopharyngeal wash/aspirate and nasal, nasopharyngeal, or oropharyngeal swabs may be collected.

Clinical Specimens for Testing

- Serology
 - Acute and convalescent serum specimens
 - Acute collected within 1 week of symptom onset
 - Convalescent collected 2-4 weeks after symptom onset
 - Other infections or concurrent illness
- Specimens should be collected within 3 days of symptom onset
- Collect all possible specimens, serial collection

27

It is also recommended that acute and convalescent serum be collected for serological testing. Acute serum should be collected within one week of symptom onset while convalescent serum should be collected 2-4 weeks after symptom onset. Serologies can also be used to test for other infections or concurrent illnesses.

All specimens, with the exception of convalescent serum, should be collected as soon as possible after symptom onset. It is best for testing purposes to collect within 3 days of symptoms onset. It is also better to collect too many specimens than not enough. Whenever possible, collect all possible specimens including upper respiratory, lower respiratory, and serum. Serial specimen collection over several days is also recommended to improve the ability to diagnose avian influenza H5N1.

Note for facilitators: *These recommendations may change if human-to-human transmission becomes common. Please determine the most up to date guidelines at the time of training.*

Clinical Specimens for Testing

- Autopsy Specimens

- Eight blocks or fixed-tissue specimens from each of the following sites
 - Central (hilar) lung with segmental bronchi
 - Right and left primary bronchi
 - Trachea (proximal and distal)
 - Pulmonary parenchyma from both right and left lung
- Major organs
 - Myocardium (right and left ventricle)
 - CNS (cerebral cortex, basal ganglia, pons, medulla, and cerebellum)
 - Organ with significant gross or microscopic pathology)

28

In the event the patient has expired, autopsy specimens may also be collected to confirm illness with avian influenza H5N1. As we previously mentioned, these should be forwarded to CDC for testing.

A minimum of 8 blocks or fixed-tissue specimens representing samples from each of the following sites should be collected for testing: central (hilar) lung with segmental bronchi; right and left primary bronchi; trachea (proximal and distal); and pulmonary parenchyma from both right and left lung.

Samples from major organs should also be collected, especially if patients suffered from myocarditis or encephalitis. Myocardium (right and left ventricle), central nervous system specimens including cerebral cortex, basal ganglia, pons, medulla, and cerebellum, and any organs with significant gross or microscopic pathology should have representative samples collected.

Influenza A

- Rapid tests

- Many commercial kits available
- Results in 15-30 minutes
- Low sensitivity
- Positive result cannot differentiate seasonal influenza A from H5N1
- Negative result does not rule out H5N1 as diagnosis

29

There are many rapid tests available that can be sold as commercial kits designed to detect influenza A. Testing is easy and results can be obtained quickly, in roughly 15 to 30 minutes. However, their results should be regarded with caution. Rapid tests have low sensitivity. In addition, there are problem in interpreting results when you suspect avian influenza H5N1. A positive result cannot differentiate seasonal influenza A from H5N1. In addition, a negative result does not mean avian influenza H5N1 can be ruled out as a diagnosis.

Laboratory Diagnostics

- CDC's influenza laboratory is nation's influenza A reference laboratory
- Capable of performing additional tests
 - Immunohistochemical testing
- CDC's Emergency Response Hotline
 - 770.488.7100

30

Just one last note on laboratory diagnostics. CDC's influenza laboratory serves as the nation's influenza A reference testing laboratory for suspect infections in humans. In addition to testing capabilities mentioned in the previous slides, there are additional tests they can perform on specimens, including immunohistochemical testing on autopsy specimens. Should any specimens need to be forwarded to CDC for testing, be sure to contact CDC's Emergency Response Hotline before sending specimens (770.488.7100).

Imaging

X-ray changes are common in the lungs of avian influenza H5N1 patients

- Non-specific changes
- Diffuse or patchy infiltrates
- Fluid in the space surrounding the lungs
- Cavities forming in the lung tissue

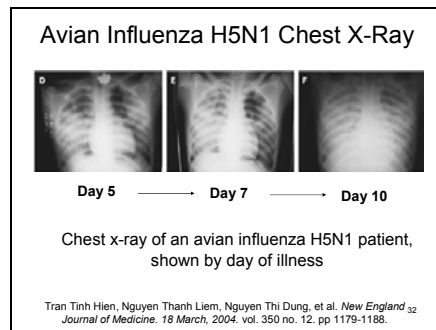


BBC News. <http://bbc.co.uk>
Saturday, 3 December 2005

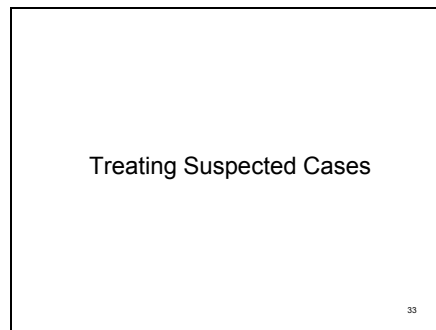
31

The final type of testing that we want to review is Imaging. Imaging is a recommended testing procedure because X-ray changes are common in the lungs of avian influenza H5N1 patients and can indicate the presence of pneumonia. This pneumonia tends to rapidly progress to respiratory distress and subsequent respiratory failure, and cases may die in spite of being ventilated.

Typical x-ray findings are fairly non-specific, including diffuse, multi-focal or patchy infiltrates, fluid in the space surrounding the lungs, and cavities forming in the lung tissue.



This excerpt from a published article illustrates the progression of pneumonia in a hospitalized patient with avian influenza H5N1 infection. You can see the lung infiltrates worsen and become more dense from day 5 to day 10.



Let's move on to discuss treatments for suspected cases.

Treatment Options

- Antivirals
 - Consider age group
- Antibiotics
- Supportive care



34

In the next slides we will discuss current recommendations for antivirals, antibiotics, and supportive care noting special considerations for young children.

Antivirals

Neuraminidase Inhibitor

- Neuraminidase enzyme breaks bond between infected cell and newly formed virus
- Inhibitor prevents enzyme from breaking bond and releasing virus
- Virus particles cannot infect other cells

35

Let's begin with antivirals. Any patient suspected of having avian influenza H5N1 infection should be treated with a neuraminidase inhibitor.

An infected cell has many virus particles on the surface of its cell, ready to infect other cells. Neuraminidase is an enzyme that breaks the bond between the infected cell and the virus particle. A neuraminidase inhibitor prevents the enzyme from breaking the bond so virus particles cannot infect other cells.

Neuraminidase Inhibitor

- Two drugs available
 - Oseltamivir (Tamiflu®) and Zanamivir (Relenza ®)
 - Should be given as soon as possible
 - Effective for treatment and prevention
 - Used for seasonal and avian



The two neuraminidase inhibitor drugs currently available are Oseltamivir, with the trade name Tamiflu, and Zanamivir, with the trade name Relenza. You should not wait for laboratory diagnosis before beginning treatment; all patients should begin treatment as soon as possible. There is some suggestion that antivirals given within 48 hours of symptom onset may improve survival. Antivirals can also be given to prevent disease from developing in those who have been exposed to the virus. These drugs are used in the treatment for seasonal and avian influenza.

Oseltamivir

Dosage for seasonal influenza

Adults:
75 mg twice a day for 5 days

Children:
<1 year, not recommended

≤ 15 kg - 30 mg twice a day for 5 days

>15 kg to ≤23 kg - 45 mg twice a day for 5 days

>23 kg to ≤40 kg - 60 mg twice a day for 5 days

>40 kg - 75 mg twice a day for 5 days



37

Oseltamivir is available in capsule or liquid form. It is recommended for treatment in people more than 1 year old. Current guidelines for Oseltamivir treatment of seasonal influenza are:

- Adults: 75 mg twice a day for 5 days

- Children: <1 year, not recommended

- If body weight is ≤ 15 kg, the dose should be 30 mg twice a day for 5 days

- If body weight is >15 kg to ≤23 kg, the dose should be 45 mg twice a day for 5

days

- If body weight is >23 kg to ≤40 kg, the dose should be 60 mg twice a day for 5

days

- If body weight is >40 kg, the dose should be 75 mg twice a day for 5 days

Oseltamivir

Dosage for avian influenza H5N1

- **Best dosage for H5N1 unknown**
 - Longer treatment (7 to 10 days) OR
 - Higher doses (150 mg)
 - Begin within 2 days of symptom onset
- **Dosage for prevention**
 - Once daily for 7 to 10 days after last exposure
- **Side Effects**
 - Nausea and vomiting
 - Skin rash

38

Oseltamivir has been used to treat avian influenza as well. No clinical trial on the effectiveness of Oseltamivir on avian influenza H5N1 infection in humans has been conducted. Therefore, the best dosage and duration for treatment is unknown. However it has been suggested that patients with avian influenza H5N1 infection may benefit from longer treatment (7 to 10 days) or higher doses (150 mg). Treatment should begin as soon as possible within 2 days of symptom onset. The dosage for *prevention* of avian influenza is once daily for 7 to 10 days after last exposure.

Side effects of Oseltamivir use can include nausea, vomiting and skin rash.

Oseltamivir

- **Effectiveness in seasonal influenza**
 - Reduces influenza symptoms 1 - 3 days
 - Reduces lower respiratory tract complications, pneumonia, and hospitalization
- **Cautions- Consider Risk versus Benefits**
 - People with kidney disease (adjust dose)
 - Pregnant or nursing females
- **Contraindication**
 - <1 year of age
 - Hypersensitivity to any component of product
- **Resistance**
 - Detected in several avian influenza H5N1 patients

39

Studies show that Oseltamivir can reduce seasonal influenza infection by one to three days. It has also been shown to reduce serious complications such as lower respiratory tract complications, pneumonia, and hospitalization. However, individuals with kidney disease will need to have their dosage adjusted, and pregnant and nursing females should avoid taking this drug.

Oseltamivir is contraindicated for those less than one year of age and anyone with hypersensitivity for any of the components of the product.

Resistance to Oseltamivir has been detected in several avian influenza H5N1 patients.

Zanamivir

- Inhaled by mouth via special device
- May be used for > 5 years of age
- Treatment dosage
 - Once in morning and night, 5 days
- Side effects
 - Wheezing, and breathing problems



40

The second neuraminidase inhibitor that we want to discuss is Zanamivir. This drug is inhaled as a powder through the mouth, and requires a special device to administer. Zanamivir is recommended for the treatment of anyone greater than 7 years of age. It should be taken once in the morning and once at night for 5 days. Side effects can include wheezing and serious breathing problems.

Zanamivir

- **Effectiveness in seasonal influenza**
 - Reduces influenza symptoms 1 - 3 days
 - Reduces lower respiratory tract complications
- **Consider Risk vs. Benefit**
 - People with chronic respiratory disease
 - Pregnant or nursing females
- **Resistance**
 - Not identified in human H5N1 infections
 - Active against Oseltamivir resistant H5N1

41

Studies show that Zanamivir can reduce human influenza infection by one to three days. It has also been shown to reduce lower respiratory tract complications. Neither people with chronic respiratory disease such as asthma nor pregnant or nursing women should take this drug. Resistance to Zanamivir has not been identified among patients with avian influenza H5N1 infections, and Zanamivir is active against Oseltamivir resistant H5N1 virus.

Other Treatments?

- **Amantadine and Rimantadine**
 - H5N1 resistant in some isolates
 - Not as effective as neuraminidase inhibitors
- **Corticosteroids**
 - Low dose for sepsis
 - Unclear if high dose useful
 - Risk of side effects
- **Ribavirin**
 - Ineffective against influenza viruses

42

For human influenza infections, Amantadine and Rimantadine are also used for treatment. However, avian influenza H5N1 has been shown to be resistant to these drugs in some patients. Furthermore, the drugs are not as effective as the neuraminidase inhibitors. However, if the first choice of drugs is not available and there is evidence that the virus might be susceptible to Amantadine or Rimantadine, these can be administered.

However, do not use Ribavirin - it is not effective against influenza viruses.

Corticosteroids have been used in low doses to treat sepsis, or a bacterial infection in the blood. It is unclear if a high dose is useful for treatment of avian influenza H5N1 infections, and there is a risk of side effects. They are generally not recommended for H5N1 influenza treatment.

Treating Children

- Different Oseltamivir dosage
 - Based on child's weight
 - Not approved in children <1 year
- No aspirin for children < 18 years of age
 - Use Acetaminophen or Ibuprofen
- Children infectious for 21 days after illness
 - If child cannot remain hospitalized, educate family about infection control



43

The treatment of children requires unique considerations and precautions. As we noted earlier, children should receive a dosage of Oseltamivir based on their weight. In addition, oseltamivir is not approved in children under one year of age.

Do *not* administer aspirin to children under 18 years of age, because of the risk of Reye's syndrome. Acetaminophen or Ibuprofen can be used instead to reduce fever and treat pain.

Unlike adults, who appear to remain infectious for 7 days after avian influenza illness, children remain infectious for 21 days after illness. If a child cannot remain hospitalized for this length of time, the family should be educated about using infection control measures in the home.

Antibiotics

- **Broad-spectrum**
 - Do not use as a prophylactic
 - Give empiric therapy for suspected bacterial pneumonia
- **Secondary bacterial infection therapy**
 - Treat with intravenous antibiotics as recommended

44

Let's now consider another category of medication: antibiotics. Broad-spectrum antibiotics are often given to pneumonia patients upon admission, but they should not be used as prophylaxis. However, if bacterial pneumonia is suspected, antibiotics can be given empirically. Bacterial causes of pneumonia are common, and with an uncertain diagnosis, many doctors will begin this therapy immediately.

Antibiotic therapy may be required to treat secondary bacterial infections in an influenza patient. Patients should be treated with intravenous antibiotics as recommended by expert guidelines, including consideration of drug resistance.

Supportive Care

Hospital care for suspected or confirmed avian influenza cases should include:

- Isolating the patient
- Supplemental oxygen and ventilation
- Intensive care support for organ failure
- Low dose corticosteroids for sepsis

45

The final component of treatment that we want to discuss is supportive care.

Whenever possible, patients with suspected or confirmed avian influenza should be hospitalized in isolation. Most hospitalized patients with avian influenza have required ventilation within 2 days of hospital admission, as well as intensive care for multi-organ failure.

In addition to empirical treatment with antivirals and broad-spectrum antibiotics, corticosteroids may also be administered. Low dose corticosteroids may be given to treat sepsis, but high dose corticosteroids should be avoided.

Infection Control in Health Care Setting

46

Infection Control Measures

- Patients hospitalized for clinical monitoring, diagnostic testing, and antiviral therapy
- Droplet and airborne precautions
 - Negative pressure
 - N95 masks or more protective
- Eye protection (within 3 feet)
 - Goggles or face shields



47

Patients should be hospitalized for clinical monitoring, diagnostic testing, and antiviral therapy. Droplet and airborne precautions should be instituted. This includes placing the patient in an airborne isolation room with negative pressure and the use of N95 respiratory masks or a more protective respiratory mask

Goggles or face shields should also be worn if within 3 feet of the patient.

Infection Control Measures

- Standard Precautions
 - Hand washing before and after contact with patient or potentially contaminated items
- Contact Precautions
 - Gloves and gown worn
 - Dedicated equipment used
- CDC recommendations
<http://www.cdc.gov/flu/avian/professional/infect-control.htm>

48

Careful attention should be given to hand washing before and after contact with patients or items that may be contaminated. Gloves and gown should be worn when in contact with patient. Dedicated equipment such as stethoscopes, disposable blood pressure cuffs, etc should be used.

For more detailed CDC recommendations for infection control measures in the healthcare workers, please visit the website listed on the slide.

We will discuss infection control measures in the home in part 3 of this training module.

Managing Corpses

- No risk of transmission from dead bodies
- Autopsy procedures could result in transmission
 - Use appropriate protective equipment
- You should know
 - Where corpses may be sent for disposal
 - Cultural or religious beliefs to respect when handling corpses

49

Of special note, you may need to be able to advise on the management of corpses with possible avian influenza. Normally, there is little or no risk of contracting avian influenza from a deceased person. However, some autopsy procedures performed after death may result in transmission. For this reason, if an autopsy is to be performed, appropriate protective equipment should be used. We will talk more on this type of protection in a later module.

Even though dead bodies pose little or no risk of transmission, you should know where corpses may be sent for preparation and disposal. It is important to keep in mind the cultural or religious beliefs that need to be respected when handling corpses.

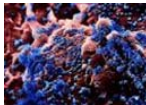
Part 2 Summary

1. Important appropriate clinical specimens are collected and tested
2. Begin treatment with neuraminidase inhibitor immediately! Do not wait!

50

In summary, there are two important points we would like to make. Diagnosis of avian influenza H5N1 requires laboratory confirmation, so it is important that appropriate clinical specimens are collected and tested. Suspected cases of avian influenza H5N1 should be treated with a neuraminidase inhibitor immediately. You should not wait for test results before beginning treatment.

Case Management of Suspect Human Avian Influenza H5N1 Infection



Part 3: Public Health Action

51

This is the final installment of the series on case management of suspect human avian influenza H5N1 infection. During this presentation we will discuss recommended public health action for suspected human avian influenza H5N1.

Learning Objectives

- Understand case management from public health perspective
- Recognize opportunities for public health authorities to effectively communicate avian influenza information

52

During Part 2, we discussed some of the actions a clinician should be advised to take when faced with a potential avian influenza patient. Now, we will focus on “What should YOU do?” as a public health authority. A suspect case of avian influenza H5N1 in a human represents a potential public health emergency. So what activities should you undertake?

By the end of part 3, you should be familiar with case management from a public health perspective. In addition, you should be able to recognize opportunities where public health authorities should take the lead to effectively communicate avian influenza information to patients and contacts.

Part 3 Session Overview

1. Collect Case Information
 - Classify case according to case definition for surveillance
2. Facilitate specimen collection and laboratory testing
3. Information on avian influenza illness
4. Infection control measures in the home
5. Active case follow up
6. Identify close contacts and recommend chemoprophylaxis

53

Many of the recommendations in this presentation have been adapted from CDC guidelines designed for conducting surveillance and investigation activities to identify and control human illnesses associated with avian influenza outbreaks among animals.

Listed on this slide are a number of items you will need to undertake in the days following the identification of a suspected avian influenza H5N1 case. We will review each item individually in the following slides.

1. Collect case information from patient using a standardized form
 - Classify cases according to case definition for public health surveillance purposes
2. Facilitate specimen collection and laboratory testing
3. Provide patient and household contacts information on avian influenza illness
4. Provide patient and household contacts information on infection control measures in the home
5. Conduct active case follow up
6. Identify close contacts and recommend chemoprophylaxis

By no means is this list exhaustive. There are many other tasks you will need to undertake that will not be reviewed in this presentation. However these actions warrant mention in our discussion of case management.

Pandemic Influenza Plan

- Know your role and responsibilities as outlined in your health department's plan
- Know key collaborators during investigation

54

Before we begin discussing public health actions we should mention pandemic influenza plans. Most state and local health departments have a pandemic influenza plan that has been modified to address the avian influenza H5N1. Therefore it is important you are familiar with your roles and responsibilities as outlined in your health department's plan. It is also important you know key collaborators during the investigation that will ensue once a suspect case is identified.

What we will discuss during this portion of Module 4 are actions that should already be in your pandemic influenza plans.

Collecting Case Information

55

Case Information

- Name of person reporting
- Healthcare facility name and location
- Patient information:

Name and contact Information
Unique Identifier
Occupation (address)
Demographic
Symptoms
Test Results

Treatment
Outcome
Travel history
Potential exposures
Close contacts

56

On this slide you will find the different types of information that should be collected from all potential avian influenza H5N1 patients. As you can see, most of the information is similar to information you routinely collect for other reportable diseases.

Name and contact Information

Unique identifier (number to be used on both laboratory and epidemiologic forms and data collection tools)

Occupation (address)

Demographic

Symptoms

Test Results

Treatment

Outcome

Travel history

Potential exposures

Close contacts

As a reminder, it is important that information be collected on standardized forms to ensure appropriate information is collected from all avian influenza H5N1 cases.

Case Definitions

- Confirmed
- Suspect
- Report under investigation
- Non-case
- Refine for outbreaks

57

Once you have collected information on patients, it is important to classify them according to a standardized case definition. Guidelines from CDC have four case definitions for avian influenza H5N1. They are confirmed, suspect, report under investigation, and non-case.

The case definitions that follow are for public health surveillance, and are useful for determining who gets laboratory testing. If you move into an outbreak situation, be sure to refine your case definitions.

The WHO case definitions you learned about earlier are designed for classifying cases for reporting purposes.

Case Definitions

Confirmed Case

- Documented temperature $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and one of the following: cough, sore throat, and/or respiratory distress AND
- One of the following exposures within 10 days of onset
 - Direct contact with sick or dead domestic poultry
 - Direct contact with surfaces contaminated with poultry feces
 - Consumption of raw or partially cooked poultry or poultry products
 - Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection
 - Works with live H5N1 influenza virus in a laboratory
- Positive for H5N1 by one of the following methods
 - Isolation of H5N1 from viral culture
 - Positive RT-PCR for H5N1
 - 4 fold rise in H5N1 specific antibody titer by microneutralization assay in paired sera
 - Positive IFA for H5 antigen using H5N1 monoclonal antibodies

58

A confirmed case is defined as an individual with a documented temperature $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and one of the following symptoms: cough, sore throat, and/or respiratory distress AND one of the following exposures within 10 days of onset

- Direct contact with sick or dead domestic poultry
- Direct contact with surfaces contaminated with poultry feces
- Consumption of raw or partially cooked poultry or poultry products
- Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection
- Works with live H5N1 influenza virus in a laboratory

In addition, the patient must have a positive test result for H5N1 by one of the following methods

- Isolation of H5N1 from viral culture
- Positive RT-PCR for H5N1
- 4 fold rise in H5N1 specific antibody titer by microneutralization assay in paired sera
- Positive IFA for H5 antigen using H5N1 monoclonal antibodies

Case Definitions

Suspect Case

- Documented temperature $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and one of the following: cough, sore throat, and/or respiratory distress AND
- One of the following exposures within 10 days of onset
 - Direct contact with sick or dead domestic poultry
 - Direct contact with surfaces contaminated with poultry feces
 - Consumption of raw or partially cooked poultry or poultry products
 - Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection
 - Works with live H5N1 influenza virus in a laboratory
- Laboratory test for H5N1 is pending, inadequate or unavailable

59

A suspect case is defined as an individual with a documented temperature $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and one of the following symptoms: cough, sore throat, and/or respiratory distress AND one of the following exposures within 10 days of onset

- Direct contact with sick or dead domestic poultry
- Direct contact with surfaces contaminated with poultry feces
- Consumption of raw or partially cooked poultry or poultry products
- Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection
- Works with live H5N1 influenza virus in a laboratory

In addition, laboratory testing for H5N1 should be pending, inadequate or unavailable.

Case Definition

• Report Under Investigation

- Additional information needed on clinical and exposure information

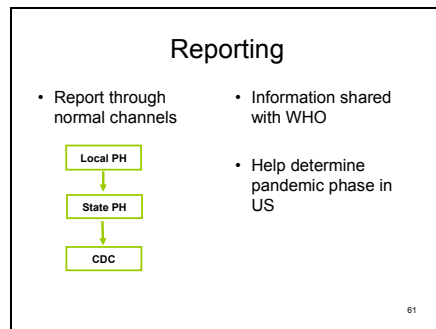
• Not a Case

- Negative H5N1 result from a sensitive laboratory testing method using adequate and appropriately timed clinical specimens

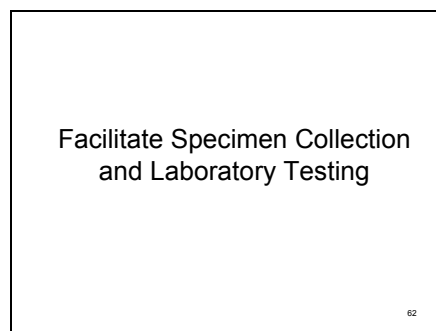
60

A case is defined as “report under investigation” if additional information is needed on clinical and exposure information in order to classify it as a “suspect case” and laboratory information is unavailable.

A case is defined as “not a case” if test results were negative for H5N1 from a sensitive laboratory method using adequate and appropriately timed clinical specimens.



Just a quick word on reporting. Although a number of states have special clauses in their infectious disease reporting requirements for “emerging diseases” and those considered “public health emergencies”, it is important that all public health authorities report cases of avian influenza through normal channels (local public health to state public health to CDC). The information provided by you will be shared with the World Health Organization (WHO) and help determine the pandemic phase of avian influenza in the US. International reporting would be carried out using the WHO case definitions.



Specimen Collection

- Best specimens
 - Lower respiratory tract
 - Bronchoalveolar lavage
 - Tracheal aspirate
 - Pleural fluid tap
 - Sputum
 - Oropharyngeal swabs
- Have supplies stocked for timely collection of appropriate specimens

63

As we mentioned in part 2 of this series, it is important you be able to offer guidance on the types of clinical specimens that should be collected for testing. Recall oropharyngeal swabs and any specimens from the lower respiratory tract (bronchoalveolar lavage, tracheal aspirate, pleural fluid tap and sputum) have the highest yield.

It may be necessary for you to collect specimens for testing. In anticipation of such a scenario, be sure to have necessary supplies stocked so you can collect appropriate specimens in a timely manner.

Laboratory Testing

- Be familiar with testing available in your area
- Know which laboratories can perform which tests
- Know tests available at CDC

64

You should also be familiar with the type of testing available in your area. Knowing which laboratories can perform which tests on clinical specimens is important since you serve as a bridge between the healthcare provider and the available laboratories. It is also important to be familiar with tests available at CDC as they may be able to offer laboratory services that other laboratories cannot provide.

Provide Information on Avian Influenza Illness

65

Avian Influenza Infection

- Emerging disease with evolving knowledge
- Empathy with public concerns
- Provide consistent and up to date literature to healthcare providers
 - Appropriate reading level
 - Translation for non-English speaking community members
- Information such as clinical features, exposure, and treatment options

66

As you know, avian influenza is an emerging disease and our knowledge about it is evolving as we encounter more cases.

The most important objective in any communication effort is to show empathy for the concerns of the population you are dealing with – they need to know that you care. This lays a foundation of trust.

Although it is likely that healthcare providers will be providing literature directly to patients, it is important that your health department gives the literature to the healthcare provider to ensure that consistent and up to date information is passed to patients and their household contacts. The reading level should be appropriate for the population and translations should be available for non-English speaking community members.

Most of the information you may provide to cases and household contacts have been included in this training module, such as clinical features, exposure, and treatment options.

Educate on Infection Control Measures in the Home

67

We will now address infection control measures that should be recommended for the home.

Infection Control Measures

- Give consistent and up to date literature to healthcare providers
- Hand washing
 - Soap and water for 15-20 seconds
 - Alcohol based sanitizer, >60% alcohol
- Limit close contact with patient



68

In some instances patients may be instructed to stay at home during their illness. Similar to literature given about avian influenza illness, public health authorities should give consistent and up to date literature to health care providers to pass along to their patients regarding infection control measures in the home.

Personal hygiene information such as hand washing should be included. Hands should be washed with soap and running water for a minimum of 15-20 seconds. If hands are not visibly soiled, alcohol-based hand sanitizers containing at least 60% alcohol can be used in lieu of soap and water. In addition, measures to prevent disease spread such as limiting close contact with the patient should also be stressed.

Infection Control Measures

- Seek medical care if condition worsens
- Stay home for 24 hours after symptoms resolve
- CDC's recommendation for in-home isolation
 - <http://www.cdc.gov/ncidod/sars/guidance/i/pdf/i.pdf>



69

Patients should be instructed to seek prompt medical care if their condition worsens. They should also stay in their homes for 24 hours after their symptoms resolve.

For further recommendations from CDC on in-home isolation, you may obtain the SARS documents on CDC's website listed on this page. You will find the information on page 21.

Conduct Active Case Follow Up

70

In addition to collecting and classifying patients, active case follow up should be conducted.

Active Follow Up

- Reasons for follow up
 - Specimens for testing
 - Timely notification of results
 - Monitor delivery of antiviral therapy
 - Secure antivirals if shortage
 - Note unusual clinical presentations or complications
- Follow up by telephone
 - Patient
 - Healthcare provider (when available)
 - Surrogate (e.g. spouse)



71

In addition to your initial interaction with the patient to collect information for your standardized form, it is important to actively follow up on the progress of the patient.

You will want to ensure appropriate specimens were collected for laboratory testing, and that there were timely notifications of results. You should carefully monitor delivery of antiviral therapy, secure antivirals if a shortage ensues, and note any unusual clinical presentations or complications that may have arisen after your initial contact.

Since you will want to limit contact with the patient, follow up may be conducted by telephone with the patient, healthcare provider (when available), or a surrogate such as a spouse.

Identify Close Contacts

72

Identifying Close Contacts

- List of contacts from patient's case report form
- Close contact = Within 3 feet
 - Sharing utensils, close conversation, direct contact
- Follow Up
 - Characterize exposure
 - Identify signs and symptoms
- Those with symptoms treated as potential avian influenza case

73

From the patient's case report form, you should have a list of individuals who were in close contact (within 3 feet) with the patient, typically household members and co-workers. Examples of close contact include kissing or embracing, sharing eating or drinking utensils, close conversation, or any other direct physical contact between persons. Close contact does not include activities such as walking or sitting by a person briefly.

These individuals should be followed up to characterize their exposure and identify any signs and symptoms of avian influenza. Those presenting with signs and symptoms should be treated as potential avian influenza H5N1 cases.

Recommendations to Contacts

No symptoms

- Receive current influenza vaccine
- PEP for close contacts of a confirmed avian influenza H5N1 case
 - Antiviral (neuraminidase inhibitor) and dosage in Part 2

74

Public health authorities should be consistent and clear in their recommendations and instructions to contacts.

Those close contacts not presenting with symptoms should receive the current human influenza vaccine if they have not already been vaccinated.

Close contacts of confirmed cases of avian influenza H5N1 should receive post-exposure prophylaxis. Recall that information on antiviral therapy, specifically neuraminidase inhibitors, and dosage were discussed in part 2 of this series.

Instruction to Contacts

No symptoms (continued)

- Self monitor for 10 days after last exposure
 - Fever, respiratory symptoms, diarrhea, and/or conjunctivitis
 - Seek medical care if symptoms present
 - Notify public health authorities
- Follow infection control measures in the home

75

Contacts should also be advised to self monitor for 10 days after their last exposure to the patient. Symptoms to look for include fever, respiratory symptoms, diarrhea and/or conjunctivitis. They should seek medical care if any of these symptoms present and should also notify public health authorities. Public health authorities should provide information to contacts regarding infection control measures in the home.

Part 3 Summary

- Public health authorities serve as protectors of their community's health
- Important that public health authorities provide clear and consistent messages to patients and contacts
- Case management also means identifying contacts

76

In summary, there are three important points you should take away from this presentation.

In addition to serving as a resource for healthcare providers, public health authorities are the protectors of their community's health. It is important that when an avian influenza H5N1 infection is suspected, public health authorities work quickly to take action in assessing and preventing the spread of the disease.

It is vital for public health authorities to be proactive in providing clear, consistent, and current information to patients and contacts.

Case management includes identifying close contacts and investigating these individuals for illness.

Glossary

Avian Influenza

A subspecies of the influenza A virus that causes influenza among fowl and poultry.

Contraindication

A specific circumstance when the use of a certain treatment could be harmful.

Seasonal Influenza

Expected rise in influenza occurrence among humans living in temperate climates; occurs during the winter season with strains of influenza that have minor changes from season to season.

77

References and Resources

- CDC Guidance for State and Local Health Departments for Conducting Investigations of Human Illness Associated with Domestic Highly pathogenic Avian Influenza Outbreaks in Animals (Draft).
- Preliminary clinical and epidemiological description of influenza A (H5N1) in Viet Nam, 12 February 2004.
http://www.who.int/csr/disease/avian_influenza/guidelines/vietnamclinical/en/index.htm
- Tran Tinh Hien, et al. Avian Influenza A (H5N1) in 10 Patients in Vietnam. *N Engl J Med* March 18, 2004; 350(12), p 1179-1181.
- WHO interim guidelines on clinical management of humans infected by influenza A(H5N1), 2 March 2004.
http://www.who.int/csr/disease/avian_influenza/guidelines/clinicalmanage/en/index.htm
- WHO pandemic influenza draft protocol for rapid response and containment. Updated draft 30 May 2006.
http://www.who.int/csr/disease/avian_influenza/guidelines/protocolfinal30_05_06a.pdf

78

Module 3

Infection Control and Personal Protective Equipment

Presentation Handouts

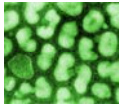
Exercises

Background Information

Infection Control and Personal Protective Equipment

Presentation Handouts

Personal Protective Equipment



Hello, and welcome to the presentation about infection control and personal protective equipment, both of which are very important topics for preventing the spread of infectious diseases.

Learning Objectives

- Demonstrate knowledge of the principles of infection control
- Recognize gaps in infection control infrastructure
- Demonstrate proper selection and use of personal protective equipment

At the end of this session, you should be able to:

- Demonstrate knowledge of the principles of infection control based upon known routes of transmission of infectious agents.
- You will also be able to recognize gaps in infection control infrastructure, and suggest ways to address them in different situations.
- Finally, you will be able to demonstrate proper selection and use of personal protective equipment in given situations.

Today we will focus on avian influenza, but it is important to remember that the principles you learn can be applied to *all* communicable diseases.

Personal Protective Equipment (PPE)

- When used properly can protect you from exposure to infectious agents
- Know what type of PPE is necessary for the duties you perform and use it correctly



PPE is available to protect you from exposure to infectious agents. It is important that you know what type of PPE is necessary for the procedures you perform AND that you use it correctly.

Types of PPE

- Gloves
- Gowns
- Masks (surgical and particulate respirator)
- Boots
- Eye protection (goggles and face shields)

We now want to discuss five types of PPE, one at a time. We will consider: gloves, gowns, masks, boots, and eye protection. Various types of PPE are used at different levels of precaution.

Precaution Levels

****All levels require hand hygiene****

- **Standard** Precautions

Transmission based precautions:

- **Contact** Precautions
- **Droplet** Precautions
- **Airborne** Precautions

There are several types of standardized infection control policies—called “precautions”—designed to prevent the spread of infectious diseases. The type of infection control precautions needed in different situations depends upon how the infection is spread. However, hand hygiene is a critical component to *all* of the precautions. So you will want to assure that hand washing facilities with soap and towels are available.

“Standard precautions” are the most basic, and assume that an infectious agent could be present in the blood. Contact, droplet and airborne precautions are used in addition to standard precautions. Contact, droplet, and airborne precautions are based on the different routes of disease transmission. Regardless of the type of precaution that you employ, each has a list of required PPE (for example, gloves or masks) as well as related infection control activities such as the use of dedicated medical instruments.

Note that these precautions apply to situations involving any pathogen. Different levels of precaution are recommended for different pathogens.

We will review the specifics of each precaution level, beginning with standard precautions. .

Standard Precautions

- Prevent the transmission of common infectious agents
- Hand washing key
- Assume infectious agent could be present in the patient's
 - Blood
 - Body fluids, secretions, excretions
 - Non-intact skin
 - Mucous membranes



Standard precautions are a set of procedures intended to prevent the transmission of common infectious agents. During care for any patient, one should assume that an infectious agent could be present in the patient's blood or body fluids, non-intact skin and mucous membranes, and secretions and excretions. Therefore, appropriate precautions that include the use of personal protective equipment (or PPE) must be taken.

- Whether PPE is needed, and if so, which type to use, is determined by:
- The type of clinical interaction with the patient
- The degree of blood and body fluid contact that can be reasonably anticipated
- By whether the patient has been placed on isolation precautions such as droplet or airborne precautions

PPE for Standard Precautions

Wear:	If:
• Gloves	• Touching – Respiratory secretions – Contaminated items or surfaces – Blood & body fluids
• Gowns	• Soiling clothes with patient body fluids, secretions
• Eye Protection and / or Mask	Procedures are likely to generate splashes / sprays of blood, body fluids, secretions, excretions

Under standard precautions,

- Wear gloves if hand contact with respiratory secretions or potentially contaminated surfaces is anticipated.
- Wear a gown if soiling of clothes with a patient's respiratory secretions is anticipated.
- Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.
- Change gloves and gowns after each patient encounter and perform hand hygiene.
- Decontaminate hands before and after touching the patient and after touching the patient's environment or the patient's respiratory secretions, whether or not gloves are worn.
- When hands are visibly soiled or contaminated with respiratory secretions, wash hands with soap (either plain or antimicrobial) and water.
- If hands are not visibly soiled, use an alcohol-based hand rub.

Droplet Precautions

- Prevent infection by large droplets from
 - Sneezing
 - Coughing
 - Talking
- Examples
 - *Neisseria meningitidis*
 - Pertussis
 - Influenza
 - Avian influenza (probable)



The next type of precaution is droplet precautions. Droplet precautions are intended to prevent infection by large droplets that are released when an infected person sneezes, coughs, or talks.

Examples of infectious diseases that are spread this way include: *Neisseria meningitidis*, Pertussis, and Influenza. It is probable that person-to-person transmission of avian influenza occurs via droplets.

Droplet Precautions

Taken *in addition to Standard Precautions*

- Place patients in single rooms or cohort 3 feet apart
- Wear surgical mask within 3 feet of patient
- Wear face shield or goggles within 3 feet of patient
- Limit patient movement within facility
 - Patient wears mask when outside of room

In addition to standard precautions, health-care workers should adhere to droplet precautions during the care of a patient with suspected or confirmed influenza for 5 days after the onset of seasonal influenza, and 14 days after the onset of avian influenza:

- Place patient in a private room. If a private room is not available, place (cohort) suspected influenza patients with other patients suspected of having influenza; cohort confirmed influenza patients with other patients confirmed to have influenza.
- Wear a surgical or procedure mask when entering the patient's room or when working within 3 feet of the patient. Remove the mask when leaving the patient's room and dispose of the mask in a waste container.
- If patient movement or transport is necessary, have the patient wear a surgical or procedure mask, if possible.

Airborne Precautions

Taken in addition to Standard Precautions

- Prevent spread of infection through very small (< 5 microns) airborne particles
- Examples
 - Tuberculosis
 - Measles
 - *Varicella*
 - *Variola*



The goal of airborne precautions is to prevent transmission of infectious particles less than 5 microns in size that remain infectious while suspended in the air. Examples of these types of infectious diseases include tuberculosis, measles, *Varicella*, and *Variola*. You may recall from earlier in this session that it is unknown whether avian influenza infection can be transmitted among humans this way.

Airborne Precautions

- Use for influenza patients when:
 - History of travel to country with avian influenza activity within 10 days
- AND
- Hospitalized with severe febrile respiratory illness
 - Or are otherwise under evaluation for avian influenza

Airborne precautions should be used for suspected avian influenza patients under the following circumstances:

Patients have a history of travel to a country with avian influenza activity within 10 days and are hospitalized with a severe febrile respiratory illness, or are otherwise under evaluation for avian influenza.

Airborne Precautions

- N95 mask (or equivalent) for personnel
 - Check seal with each use
- Negative pressure isolation room
 - Air exhaust to outside or re-circulated with HEPA filtration
- Patient to wear a surgical mask if outside of the isolation room

In addition to PPE used for standard precautions, airborne precautions require use of a particulate respirator that is at least as protective as an N-95 respirator. The respirator should be fitted, and the user should check to make sure that the seal is working with *each* use.

Under airborne precautions, the patient is to stay in a negative pressure isolation room. The air from that room should *not* be re-circulated into the rest of the building; rather, it should be ventilated to the outdoors away from populated areas or recirculated via a high efficiency particulate air (HEPA) filter.

If a patient leaves the isolation room, he or she should wear a surgical mask.

Sequence for Donning PPE

1. Wash hands
2. Gown
3. N95 Particulate respirator
 - Perform seal check
4. Hair cover
5. Goggles or face shield
6. Gloves

This next segment will address the sequence of donning and removing PPE specifically when caring for patients with suspected or confirmed avian influenza.

Before donning PPE, always perform hand hygiene practices. The gown should be donned first. The respirator should be put on next and properly adjusted to fit; remember to fit check the respirator. If you will be involved in an aerosol-generating procedure, you may choose to wear a hair cover and/or boots. The goggles or face shield should be donned next, and the gloves are donned last.

Sequence for Removing PPE

Remove in anteroom when possible

1. Untie gown and remove shoe covers
2. Gloves
3. Wash hands
4. Gown (and apron, if worn)
5. Goggles
6. Mask
7. Cap (if worn)
8. Boots
9. Wash hands

The sequence for removing PPE is intended to limit opportunities for self-contamination; the exact order is not as important as limiting contamination, so you can change it if necessary.

Ideally, PPE should be removed in the anteroom. If there is no anteroom, make sure that the environment (and people) outside of the isolation room are not at risk of contamination. The suggested order for removing PPE is listed here. After removal, wash your hands for a second time, this time up to the wrists, with soap and water, and dry them. The final step is to decontaminate your hands using a 70% alcohol hand rub before you leave the facility.

Instructor Demonstration: Don and Remove PPE



OPTIONAL:

Now let's take a break from the lecture to practice safely donning and removing PPE. First, your instructor will demonstrate the appropriate method of donning and safely removing PPE. You will then have an opportunity to practice the procedures both alone and with a partner.

Facilitator Note: Demonstrate procedures as indicated, or have a designated person conduct the demonstration. Narrate to trainees as each piece of equipment is donned and removed.

Choosing the Appropriate PPE

Next we will touch on which elements of PPE to use in different situations.

Avian Influenza

- Likely large droplet transmission
- Possible airborne transmission
- Recommended PPE varies depending on situation

For avian influenza, the transmission is likely through droplet spread, however airborne transmission has not been ruled out. The choice of PPE therefore depends on several factors, including the likelihood that the person is infected (e.g. different recommendations for a confirmed case v. a person under investigation), the setting (e.g. community v. hospital).

Interviewing - Asymptomatic Exposed Persons and Contacts

- Low-risk activity
- Routine use of PPE not recommended
- Maintain 3 feet distance between interviewer and interviewee
- Use proper hand hygiene
 - May use hand sanitizer (at least 60% alcohol) if hands not visibly soiled

Interviewing people who are asymptomatic and who either may have been exposed, or who are contacts of a suspect or confirmed case, is considered a low-risk activity. The routine use of PPE in this situation is not recommended. Some precautions, however, should be used, such as maintaining 3 feet of distance between interviewer and interviewee, and using proper hand hygiene. Note that if hands are not visibly soiled, a hand sanitizer that is at least 60% alcohol may be used.

Interviewing - Symptomatic Exposed Persons

- Higher risk activity
- PPE recommended in community and healthcare facility
 - Contact precautions
 - Droplet precautions
 - N95 respirator
- In healthcare facility, person should be placed in airborne isolation room

Conducting interviews with persons who have been exposed and who are symptomatic is a higher risk activity. Therefore, the use of PPE recommended in when interviewing these individuals both in the community, or in a healthcare facility. Contact and droplet precautions should be used, including an N95 respirator. If they are in a healthcare facility, the exposed persons should be placed in airborne isolation rooms.

**Specimen Collection – Exposed
Persons and Birds**

- High-risk aerosol-generating procedure
- PPE recommended
 - Gloves
 - Gown
 - Goggles or face-shield
 - N95 or better respirator

Collecting specimens either from people or from animals is a high-risk, aerosol-generating procedure. Full PPE is recommended, including Gloves, Gown, Goggles or face-shield, and N95 or better respirator.

Activities

- Participate in group discussions using the Trainee Guide

Now we will break out into groups so that you may work through group discussions.

Infection Control and Personal Protective Equipment

Exercises

Exercise 3

Infection Control and Personal Protective Equipment (PPE)

Part 1: Group Discussion/Brainstorming Activity- Accessing and Prioritizing PPE during an Avian Influenza Pandemic

Objectives:

Know where to get personal protective equipment (PPE), who should use it, and understand how to prioritize its use.

Instructions:

1. Take 5 minutes to read through the following questions individually and contemplate responses.
2. Discuss each question as a group; designate one group member to record group responses.

Time allotted: 20 minutes

Question 1 – Does your local animal and/or human health rapid response team have access to all types of PPE (gloves, gowns, goggles/face shields, boots, surgical masks, and respirators)? If not, which types of PPE are needed?

***Suggested Answer** – Prompt group members to contribute standard PPE procedures in their jurisdictions. If members are from separate jurisdictions, ask them to compare any policies or procedures in place for using PPE.*

Question 2 – Where is the PPE stored? How will the rapid response team (RRT) access the PPE?

***Suggested Answer** – Answers will vary.*

Question 3: Have all RRT members in your jurisdiction been trained in the proper use of PPE and fitted for an N95 mask?

***Suggested Answer** – Answers will vary.*

Question 4 – What other groups (besides the rapid response team) may need PPE in the event of an avian influenza outbreak? Is equipment available for these

groups? Do they know how to access the equipment? Have they been trained in the proper use of PPE?

Suggested Answer – *Other first responders, such as EMT's and hospital personnel would need PPE. The group may think of others, depending on the response plan in their jurisdiction.*

Question 5 – What do you think about advising members of the public who are concerned about exposure to avian influenza to wear masks?

Suggested Answer – *Unless there is a pandemic, advising the general public to wear masks will not reduce their risk (since it is already quite low). You might be tempted to tell the public to wear masks if it makes them feel more secure; however this may cause a panic rush on masks. It is probably best to communicate the low level of risk to the general public, educate them about what activities are high risk, and how to protect themselves via hygiene and equipment. There may be differing viewpoints among the group, however, especially since the early stages of a pandemic will be unpredictable. If human-to-human transmission is sustained, look to the Federal government and federal health authorities to provide guidance. Recommendations might change quickly and might be geographically or risk-based.*

Question 6 – What could you do if personal protective equipment supplies were limited or unavailable during an avian influenza pandemic? How would you prioritize the use of PPE in your area?

Suggested Answer – *One option is reusing the PPE. If the PPE must be reused, it should be reused during one shift for one patient and discarded at the end of each shift. The technique for removing then will be different from what we have learned. Once a gown is removed, hang the gown with outside facing in. To reuse a mask or respirator, you may need to touch the front of the mask. In this situation, you need to wash your hands immediately after removing the mask. Put the mask into a sealable bag; do not put it in your pocket.*

Participants should discuss how PPE may be prioritized – perhaps by type of patient (i.e. symptomatic, confirmed cases), or by type of user (those collecting specimens, or giving treatment, etc). Participants should also be encouraged to consider all of the different groups that may need PPE (e.g. hospitals, EMS, outpatient clinics) and whether these groups have their own supplies of PPE or will be relying on the health department to provide additional PPE.

Part 2: Group Discussion and Problem Solving Activity- Applying Infection Control Measures to Different Situations

Objectives:

Group members will know when and how to apply infection control measures.

Instructions:

Four scenarios with varying complexity are described below. Engage in group discussion to determine which infection control measures would be most appropriate for each scenario.

Time allotted: 30 minutes

Scenario 1

While no human avian influenza cases have yet been confirmed in the U.S., a highly pathogenic avian influenza subtype has been identified in poultry in your area. You are asked to lead a team that is being sent to identify and interview people who may have been exposed to infected birds on a small farm. You do not expect that your team will have direct contact with birds, but you may be near areas where the poultry were housed.

Question 1 – Based on what you know about infection control, what Personal Protective Equipment (PPE) would you bring on this initial visit?

Suggested Answer – *As always, hand hygiene is the most important recommendation, and the team should bring an alcohol-based sanitizer in case running water isn't readily available. Because the team doesn't know whether any of the contacts is symptomatic, they should bring full PPE (gloves, gown, eye protection, surgical masks, and N95 respirators), but may refrain from using it unless they identify a symptomatic individual.*

Question 2 – If the PPE that you planned to bring is unavailable or cannot be accessed for some reason, how would you proceed?

Suggested Answer – *There are several options available to the team. They could contact a local hospital and request to use some of their PPE. They could conduct screening interviews over the phone to determine if anyone is symptomatic. If so, they could refer the person to the hospital, and if not, the team may conduct the in-person interviews without wearing PPE, if they maintain 3 ft distance and*

practice good hand hygiene. A way to avoid the need for PPE is to conduct all possible interviews by phone.

Scenario 2

You are now arriving at the small farm and are preparing to conduct interviews. Your van is stocked with enough full PPE for your rapid response team, but local and state government officials are already on the scene for publicity purposes, and you notice that none are wearing PPE. You don't yet know whether any individuals on the farm have flu-like symptoms.

Question 3– How do you proceed? Will you conduct interviews without wearing PPE?

Suggested answer – *This is a dilemma. A first step would be to find out from other responders (i.e. Agriculture) if anyone on the farm has been determined to be symptomatic.*

If some individuals are symptomatic, or if this information is unknown, wearing PPE is probably advisable. However, the use of PPE may generate fear among the farm workers and the viewing public, and perhaps among the officials if they did not have PPE available to them. Ideally, the team should use PPE for themselves, and also provide PPE to other rapid response officials, especially those who will have direct contact with poultry or poultry manure.

Scenario 3

While you are conducting an interview of a person who may have been exposed to sick poultry, the interviewee reports that she has a fever and diarrhea. You are not wearing any PPE.

Question 4 – Ideally, what PPE should be worn when interviewing a symptomatic exposed person?

Suggested Answer – CDC recommends that you take contact and droplet precautions, plus use an N95 or better respirator when interviewing symptomatic patients.

Question 5 – How do you proceed in this situation?

Suggested Answer – Participants should be encouraged to identify the barriers to using PPE in this situation, and brainstorm about strategies to adequately protect themselves while understanding the needs of the interviewee.

Scenario 4

There are two suspected human cases of avian influenza in a local hospital. One case was admitted directly to the hospital. The second case initially presented in the emergency room, and was admitted to the hospital after mentioning his contact with ill poultry. The hospital has put the patients in separate, private rooms. Your team has been called to interview these suspected cases.

Question 6 – Which personal protective equipment will you wear during these interviews in the hospital setting?

Suggested Answer – Since these are symptomatic exposed persons, the recommendations call for use of full PPE, including the N95 respirator.

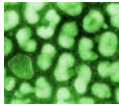
Question 7 – Are there other infection control measures that should be taken in this situation?

Suggested Answer – The team leader should ask hospital staff whether rooms are designed for airborne isolation, and recommend this measure if it is not already being used. Also, there should be immediate follow-up with other patients who were in the emergency room when the suspect case arrived. If a hospital does not have any negative air pressure rooms, it might be possible to create one (you would have to speak with a hospital environmental engineer). If you aren't able to create one, the next best option would be to cohort the patients with confirmed avian influenza. It may be possible to keep these patients in a separate room with limited access, and with ventilation directly to the outdoors.

Infection Control and Personal Protective Equipment

Background Information

Principles of Infection Control and Personal Protective Equipment



Welcome to the presentation about infection control and personal protective equipment, both of which are very important topics for preventing the spread of infectious diseases.

Learning Objectives

- Demonstrate knowledge of the principles of infection control
- Recognize gaps in infection control infrastructure
- Recognize ways to address gaps in infection control infrastructure in different situations
- Demonstrate proper selection and use of personal protective equipment

At the end of this presentation, you should be able to:

- Demonstrate knowledge of the principles of infection control based upon known routes of transmission of infectious agents.
- Recognize gaps in infection control infrastructure, and suggest ways to address them in different situations.
- Demonstrate proper selection and use of personal protective equipment in given situations.

Today we will focus on avian influenza, but it is important to remember that the principles you learn can be applied to *all* communicable diseases.

Session Overview

- Disease transmission
- Introduction to personal protective equipment (PPE)
 - How to use PPE
 - Demonstration
- Infection control precautions
 - In health care facilities
 - In the community

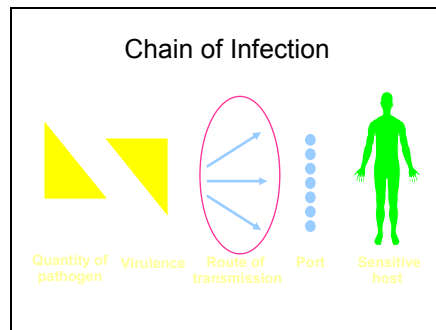
Now that you know what you will learn in this session, here is an overview of the order in which we will discuss critical topics:

First, we will discuss how communicable diseases are transmitted. We will then introduce you to Personal Protective Equipment—referred to as PPE throughout these training modules—and how to properly use the equipment. You will also know how to assess any related needs for materials during an outbreak investigation, and how to prioritize PPE when working with limited resources.

We will discuss infection control precautions in health care facilities so you know how to prevent patient-to-health care worker and patient-to-patient transmission of avian influenza. Finally, we will teach you how to prevent person-to-person spread of avian influenza within a community.

Routes of Disease Transmission

Let's begin with our first topic: Routes of Disease Transmission.



This slide shows a picture of infection transmission. There must be enough of the pathogen, and the pathogen must be virulent enough to cause disease. The pathogen moves through a route of transmission, and contacts a “port of entry,” such as eyes, nose, mouth, or puncture wound, to enter the sensitive host. An effective method to prevent healthcare workers and others from getting an illness is to know the route of transmission, and take precautions to prevent the pathogen from being transmitted.

So next, let’s discuss different routes of transmission.

Routes of Transmission

- **Respiratory**
 - Cough
 - Sneeze
- **Fecal-oral**
 - Feces contaminate food, environment, or hands
- **Vector-borne**
 - Transmitted by insects

There are several possible routes of disease transmission, and three are listed here: respiratory, fecal-oral, and vector-borne. We will also discuss human-to-human transmission.

Respiratory transmission occurs when infection is transmitted from the respiratory tract of one individual to the mucus membranes (eyes, nose, or mouth) of another individual. This usually occurs through a cough or a sneeze. Respiratory transmission can be direct, through droplets of oral or nasal secretions, or indirect, through contaminated surfaces or tiny particles that travel in the air.

Fecal-oral transmission usually occurs with organisms that infect the gastro-intestinal tract; these are known as “enteric” organisms. These agents grow and multiply in the intestines, and are shed from the body to the environment in feces. The agents can then contaminate food or water supplies through inadequate sewage treatment or irrigation practices that use untreated water. People can then become infected when the agent enters the body through ingestion of contaminated food or water.

Vector-borne diseases are transmitted through insects such as mosquitoes, fleas, and ticks. Depending on the disease, the disease agent may multiply or undergo physiologic changes within the vector.

Human-to-human, or person-to-person, spread of disease describes the process of one person spreading an infectious disease to others. People are the main source of infection, as opposed to contracting disease from animals or from agents surviving in the environment.

Routes of Transmission Contact	
<u>Direct Contact</u>	<u>Indirect Contact</u>
• Host comes into contact with reservoir • Kissing, skin-to-skin contact, sexual intercourse • Contact with soil or vegetation	• Disease is carried from reservoir to host • Contaminated surfaces (fomites)

If a person is to acquire an infectious agent, some type of contact between the individual and the source of infection must occur. Some agents are spread through direct contact, while others are spread through indirect contact.

Examples of direct contact include person-to-person mechanisms such as kissing, skin-to-skin contact, and sexual intercourse, as well as direct contact with animals, soil or vegetation. Indirect contact occurs when an agent is carried from a reservoir (the source of infection) to a susceptible host without direct contact with that source. For example, by breathing particles in the air or by touching a contaminated surface, a person can become infected.

Routes of Transmission Droplet
Large droplets within 1 meter transmit infection via: – Coughing, sneezing, talking – Medical procedures Examples: • Diphtheria • Pertussis (Whooping Cough) • Meningococcal meningitis

Droplet transmission involves contact of the conjunctivae or the mucous membranes of the nose or mouth of a susceptible person with large-particle droplets containing microorganisms generated from a person who is infected with the microorganism. Droplets are generated primarily during coughing, sneezing, or talking and during the performance of certain procedures such as suctioning and bronchoscopy. Transmission via large-particle droplets requires close contact between people, because droplets do not remain suspended in the air and generally travel only 1 meter or less before falling to the ground or to surfaces.

Some examples of diseases that spread via large droplets are pharyngeal diphtheria, pertussis, and meningococcal meningitis.

Routes of Transmission
Airborne (droplet nuclei)

Very small particles of evaporated droplets or dust with infectious agent may...

- Remain in air for a long time
- Travel farther than droplets
- Become aerosolized during procedures

Examples:

- Tuberculosis
- Measles (Rubeola)

Airborne transmission occurs by dissemination of either airborne droplet nuclei (small-particle residue [$5\text{ }\mu\text{m}$ or smaller in size] of evaporated droplets that may remain suspended in the air for long periods of time) or dust particles containing the infectious agent. Microorganisms carried in this manner can be dispersed widely by air currents and may become inhaled by or deposited on a person within the same room or over a longer distance from the source patient, depending on environmental factors. Certain therapeutic procedures usually performed in the emergency room or the intensive care unit, can generate aerosolized droplet nuclei.

Transmission of Influenza Viruses		
	Seasonal Influenza in Humans	Avian Influenza in Humans
Droplet	Yes	Probable (human to human)
Airborne	During aerosol-generating procedures	Yes?
Contact	Yes?	Yes (bird to human)

Now that you are familiar with the general routes of infection transmission, we will discuss how influenza viruses, with specific attention given to avian influenza in humans, are spread.

Seasonal human influenza viruses are mainly spread from person to person through droplets produced when an infected person coughs, sneezes or talks. There is limited evidence that seasonal human influenza is transmitted through the air in general, but transmission may occur during aerosol-generating medical procedures. Seasonal human influenza can persist in the environment (for example, on surfaces) and so is thought to be spread through direct and indirect contact.

It is believed that most cases of avian influenza in *humans* is caused by close contact with infected birds or surfaces that have been contaminated with secretions or excretions from infected birds. For example, activities such as plucking and preparing ill birds, handling fighting cocks and consumption of duck's blood or possibly undercooked poultry have all been implicated in bird-to-human cases of avian influenza. Person-to-person spread of avian influenza viruses has been reported very rarely thus far. To date, all secondary cases have had close contact with primary cases and have not used any type of personal protection (such as gloves or face masks). Therefore, person-to-person transmission of avian influenza probably occurs through infected droplets.

Infection Control Methods and Personal Protective Equipment

We will now turn our attention to Personal Protective Equipment, or PPE, in detail. PPE is an important component of infection control used to protect the spread of infection to other people and to the environment.

Hand Washing

Method

- Wet hands with clean (not hot) water
- Apply soap
- Rub hands together for at least 20 seconds
- Rinse with clean water
- Dry with disposable towel or air dry
- Use towel to turn off faucet



While not formally a type of PPE, we will first discuss hand hygiene, because it is the cornerstone of infection control! Always remember to wash hands in between contact with each new patient. This slide describes effective hand hygiene techniques:

When washing hands with soap and water, first wet hands with water, then apply the amount of soap recommended by the manufacturer. Rub hands together for at least 20 seconds, covering all surfaces of the hands and fingers. Rinse hands with water, dry them thoroughly with a disposable towel, and use the towel to turn off the faucet. Of course, this assumes that clean water is available. If there is any doubt about this, boiled or bottled water, or water treated with chlorine tablets should be used.

***Source:** Guideline for Hand Hygiene in Health-care Settings. *MMWR* 2002; vol. 51, no. RR-16.

Alcohol-based Hand Rubs

- Effective if hands not visibly soiled
- More costly than soap & water

Method

- Apply appropriate (3ml) amount to palms
- Rub hands together, covering all surfaces until dry

If hands are not visibly soiled, alcohol-based hand cleaners are also effective. When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. The volume to use depends on the manufacturer directions, but usually a coin-sized amount in your hand is sufficient.

Personal Protective Equipment (PPE)

- When used properly can protect you from exposure to infectious agents
- Know what type of PPE is necessary for the duties you perform and use it correctly



PPE is available to protect you from exposure to infectious agents. It is important that you know what type of PPE is necessary for the procedures you perform AND that you use it correctly.

Types of PPE

- Gloves
- Gowns
- Masks
- Boots
- Eye protection

We now want to discuss five types of PPE, one at a time. We will consider: gloves, gowns, masks, boots, and eye protection.

Types of PPE

Gloves

- Different kinds of gloves
 - Housekeeper gloves
 - Clean gloves
 - Sterile glove
- Work from clean to dirty
- Avoid "touch contamination"
 - Eyes, mouth, nose, surfaces
- Change gloves between patients



First we'll discuss gloves. Gloves protect the user against contamination with infectious material, but it's important to realize that gloves may become *sources* of contamination if they are not used carefully. There are different kinds of gloves that are used for different purposes. Thick rubber gloves may be used for cleaning or housekeeping purposes in a patient's room. Clean gloves might be used for general contact in the room or with the patient, while sterile gloves should be used when collecting specimens or conducting any type of medical procedure on the patient.

Here are some "do's and don't" of glove use:

Work from clean to dirty. This is a basic principle of infection control. In the context of working with possible or confirmed avian influenza patients, it refers to touching clean body sites or surfaces before you touch dirty or heavily contaminated areas.

Limit opportunities for "touch contamination" - protect yourself, others and environmental surfaces. An example of "touch contamination" is when someone wearing gloves touches his or her face or adjusts glasses with gloves that have been in contact with a patient. Touch contamination can potentially expose a person to infectious agents. Think about environmental surfaces, too, and avoid unnecessarily touching them with contaminated gloves. Surfaces such as light switches and door and cabinet knobs can become contaminated if touched by soiled gloves.

Change gloves as needed, if this is possible. If gloves become torn or heavily soiled and additional patient care tasks must be performed, then change the gloves before starting the next task. **Always** change gloves after use on each patient, and discard them in the nearest appropriate receptacle. Patient care gloves should never be washed and used again. Washing gloves does not necessarily make them safe for reuse; it may not be possible to eliminate all microorganisms and washing can make the gloves more prone to tearing or leaking.

Types of PPE

Gowns

- Fully cover torso
- Have long sleeves
- Fit snugly at the wrist



Gowns are generally the preferred PPE for clothing, but aprons occasionally are used where limited contamination is anticipated. If contamination of the arms can be anticipated, a gown should be selected. Gowns should fully cover the torso, fit comfortably over the body, and have long sleeves that fit snugly at the wrist.

Types of PPE

Masks and Respirators: Barriers and Filtration

- Surgical masks
 - Cotton, paper
 - Protect against body fluids and large particles
- Particulate respirators (N95)
 - Fit testing essential
 - Protect against small droplets and other airborne particles
- Alternative materials (barrier)
 - Tissues, cloth



Masks are another type of PPE. Wear masks that fully cover your nose and mouth to prevent fluid penetration. Masks should fit snugly, so ones with a flexible nose piece that can be secured to the head with string ties or elastic are preferable.

Respirators that filter the air before it is inhaled have been designed to protect the respiratory tract from airborne transmission of infectious agents. A commonly used respirator in healthcare settings is the N95 particulate respirator. The device has a sub-micron filter capable of excluding particles that are less than 5 microns in diameter. Prior to use, respirators should be fit tested for the appropriate size. And you should always check your respirator before use to make sure it has a proper seal.

Please note that there are many other masks and respirators on the market that have not been cleared by the FDA for medical use. These may include respirators certified by the National Institute for Occupational Safety and Health (NIOSH), and intended for use in other occupational settings, such as woodworking, metalworking, and masonry. The N95 surgical respirator is the one that has been approved and recommended by the FDA for medical use. See <http://www.fda.gov/cdrh/ppe/masksrespirators.html>. Although the N95 respirator is recommended, there are other respirators that provide equal or better protection, including the 8 other types of particulate respirators (next slide), and powered air purifying respirators (PAPRs).

If surgical masks and respirators are not available, other materials such as tissues and cloth may be used to cover the nose and mouth. While the efficacy of these materials has not been scientifically evaluated, they are probably better than no mouth covering at all.

Types of PPE

Particulate Respirators

- Three types: disposable, reusable, powered air purifying respirators
- Disposable Particulate Respirators
 - Classified N95, N99, N100, R95, R99, R100, P95, P99, P100
 - Letter indicates oil resistance: N = not resistant, R = somewhat resistant, P = strongly resistant
 - Number is percent of airborne particles filtered (e.g. N95 filters 95% of particles)

Particulate respirators filter out particles from the air, and are the type of respirator generally used for prevention of infectious disease transmission. There are three types of particulate respirators: disposable or filtering facepiece respirators, reusable or elastomeric respirators, and powered air purifying respirators (PAPRs).

There are nine types of disposable particulate respirators, based on the level of oil resistance and the percent of particles filtered by the mask. Any of the nine types can be used for infection control for avian influenza. Masks with an “N” prefix are not oil resistant, while R indicates some resistance and P indicates strong resistance to oil. Oil resistance is important in some industries that use particulate respirators, but not so important for infection control purposes. The number indicates the percent of particles that are filtered by the mask in NIOSH testing facilities.

Reference: NIOSH. Understanding Respiratory Protection Against SARS.

<http://www.cdc.gov/niosh/npptl/topics/respirators/factsheets/respsars.html>

Types of PPE

Boots



Eye Protection

- Face shields
- Goggles



Boots (either disposable or washable) are used to prevent contamination of footgear that may be tracked around and subsequently spread contamination. Eye protection is also important.

Goggles provide barrier protection for the eyes. Personal prescription lenses do not provide optimal eye protection and should not be used as a substitute for goggles. Goggles should fit snugly over and around the eyes or personal prescription lenses. You can use a face shield as a substitute to wearing a mask or goggles. The face shield should cover the forehead, extend below the chin, and wrap around the side of the face.

PPE Supplies

- Maintain adequate, accessible supplies
- Creative alternatives (not proven to be effective)
 - Mask: tissue, scarf
 - Boots: plastic bags
 - Gown: laboratory coat, scrubs

Now that you know what the key personal protective equipment items are, you should be sure to have a supply ready to be used on short notice.

If supplies are unavailable or unaffordable, you may be able to use creative alternatives in an emergency. But please note that alternatives are NOT recommended, as they do not provide the same protection as standard PPE. However, having some protection is better than no protection at all.

Some alternatives for masks that you might use are tissues and scarves, as mentioned earlier. If boots are needed but not available, plastic bags can be secured over shoes and ankles. And disposable or washable laboratory coats or surgical scrubs can be used if protective gowns are not available.

In all cases, make sure that once you remove personal protective equipment, you properly dispose of or handle it in such a way that it does not contaminate those who use, wash, or dispose of it.

Working with Limited Resources

- Avoid reuse of disposable PPE items
 - Consider reuse of some disposable items only as an **urgent, temporary** solution
 - Reuse only if no obvious soiling or damage
- When prioritizing PPE purchase
 - Masks
 - Gloves
 - Eye protection

The maintenance of an adequate supply of personal protective equipment should be a priority, as reuse of disposable PPE items should be avoided. Not much is known about reusing disposable PPE items when working with influenza patients, but reuse may increase the potential for contamination. This risk must be balanced against the need to fully provide protection for health care workers. If a sufficient supply of PPE items is unavailable, health care facilities may consider reuse of some disposable items only as an urgent, temporary solution **and** only if the item has not been obviously soiled or damaged (for example, creased or torn). If resources are limited and only certain types of PPE can be purchased and stockpiled for an adequate supply, masks are probably the best intervention against avian influenza infection transmission. Gloves and eye protection would be the next highest priorities.

Infection Control Precautions

Infection control precautions are the activities aimed at preventing and the spread of pathogens between patients, from healthcare workers to patients, and from patients to healthcare workers in the healthcare setting.

Precaution Levels

All levels require hand hygiene

- Standard Precautions

Transmission based precautions:

- Contact Precautions
- Droplet Precautions
- Airborne Precautions

There are several types of standardized infection control policies—called “precautions”—designed to prevent the spread of infectious diseases. The type of infection control precautions needed in different situations depends upon how the infection is spread. However, hand hygiene is a critical component to *all* of the precautions. So you will want to assure that hand washing facilities with soap and towels are available.

“Standard precautions” are the most basic. Contact, droplet and airborne precautions are used in addition to standard precautions. Contact, droplet, and airborne precautions are based on the different routes of transmission that we discussed earlier. Regardless of the type of precautions that you employ, each has a list of required PPE (for example, gloves or masks) as well as related infection control activities such as the use of dedicated medical instruments.

Note that these precautions apply to situations involving any pathogen. Different levels of precaution are recommended for different pathogens.

We will review the specifics of each precaution level, beginning with standard precautions. .

Standard Precautions

- Prevent the transmission of common infectious agents
- Hand washing key
- Assume infectious agent could be present in the patient's
 - Blood
 - Body fluids, secretions, excretions
 - Non-intact skin
 - Mucous membranes



Standard precautions are a set of procedures intended to prevent the transmission of common infectious agents. During care for any patient, one should assume that an infectious agent could be present in the patient's blood or body fluids, non-intact skin and mucous membranes, and secretions and excretions. Therefore, appropriate precautions that include the use of personal protective equipment (or PPE) must be taken.

Whether PPE is needed, and if so, which type to use, is determined by:

- The type of clinical interaction with the patient
- The degree of blood and body fluid contact that can be reasonably anticipated
- By whether the patient has been placed on isolation precautions such as droplet or airborne precautions

PPE for Standard Precautions

Wear:	If:
• Gloves	• Touching – Respiratory secretions – Contaminated items or surfaces – Blood & body fluids
• Gowns	• Soiling clothes with patient body fluids, secretions
• Eye Protection and / or Mask	Procedures are likely to generate splashes / sprays of blood, body fluids, secretions, excretions

Under standard precautions,

- Wear gloves if hand contact with respiratory secretions or potentially contaminated surfaces is anticipated.
- Wear a gown if soiling of clothes with a patient's respiratory secretions is anticipated.
- Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.
- Change gloves and gowns after each patient encounter and perform hand hygiene.
- Decontaminate hands before and after touching the patient and after touching the patient's environment or the patient's respiratory secretions, whether or not gloves are worn.
- When hands are visibly soiled or contaminated with respiratory secretions, wash hands with soap (either plain or antimicrobial) and water.
- If hands are not visibly soiled, use an alcohol-based hand rub.

Contact Precautions

Taken *in addition to* Standard Precautions

- Limit patient movement
- Isolate or cohort patients
- Gown + gloves for patient / room contact
 - Remove immediately after contact
- Do not touch eyes, nose, mouth with hands
- Avoid contaminating environmental surfaces

Contact precautions are the standard precautions taken when there is potential for coming into direct or indirect physical contact with a patient's body fluids or the patient environment.

Contact precautions should be used when dealing with patients that may have H5N1 influenza. In *addition* to all of the recommendations for standard precautions, contact precautions involve several other steps. These include:

- Limiting patient movement
- Placing patients in private rooms (this is known as **isolation**) or having patients with the same infection status share a room (this is known as **cohorting**)

Contact precautions require wearing gloves and a gown for all contact with patients or patients' rooms. These should be put on before entering the patient's room, and removed immediately after the contact is completed, before leaving the room. Gloves and gowns should be removed and discarded after patient care, while you are still inside the patient's room. Furthermore, health care workers should refrain from touching their eyes, nose, or mouth with potentially contaminated hands or gloves. And finally, health care workers should avoid contaminating environmental surfaces such as door knobs and light switches.

Contact Precautions

- Wash hands immediately after patient contact
- Use dedicated equipment if possible
 - If not, clean and disinfect between uses
- Clean, then disinfect patient room daily
 - Bed rails
 - Bedside tables
 - Lavatory surfaces
 - Blood pressure cuff, equipment surfaces

Contact precautions also require hand hygiene immediately after leaving the patient room. It is also advisable to keep equipment such as stethoscopes dedicated to *only* the infectious patient, if possible. If this is not possible, equipment used on the patient should be cleaned and disinfected in between uses.

Finally, contact precautions call for the patient room to be cleaned daily with an effective disinfectant. Attention should be paid to frequently touched surfaces such as bed rails, bedside tables, lavatory surfaces, blood pressure cuffs, and equipment surfaces.

Cleaning and Disinfection for Contact Precautions

- **Detergents**
 - Remove dirt, soiling
 - Mechanical force essential
 - Flush with clean water
- **Disinfectants**
 - Kill viruses, bacteria
 - Decontaminate surfaces
 - Type depends on infectious agent
 - Use *after* detergent

Let's briefly review the distinction between detergents and disinfectants that you might use as part of contact precautions. Detergents are used to clean a surface or area from organic material and disinfectants are used to decontaminate that same surface from infectious agents. The type of disinfectant to use depends on the agent. It is important to remember that a surface must be cleaned of all organic material before disinfection; otherwise, the disinfectant may be ineffective.

Droplet Precautions

- Prevent infection by large droplets from
 - Sneezing
 - Coughing
 - Talking
- Examples
 - *Neisseria meningitidis*
 - Pertussis
 - Influenza
 - Avian influenza (probable)



The next type of precaution is droplet precautions. Droplet precautions are intended to prevent infection by large droplets that are released when an infected person sneezes, coughs, or talks.

Examples of infectious diseases that are spread this way include: *Neisseria meningitidis*, Pertussis, and Influenza. As we noted earlier, it is probable that person-to-person transmission of avian influenza occurs via droplets.

Droplet Precautions

Taken in addition to Standard Precautions

- Place patients in single rooms or cohort 3 feet apart
- Wear surgical mask within 3 feet of patient
- Wear face shield or goggles within 3 feet of patient
- Limit patient movement within facility
 - Patient wears mask when outside of room

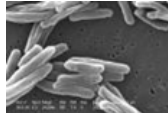
In addition to standard precautions, health-care workers should adhere to droplet precautions during the care of a patient with suspected or confirmed influenza for 5 days after the onset of seasonal influenza, and 14 days after the onset of avian influenza:

- Place patient in a private room. If a private room is not available, place (cohort) suspected influenza patients with other patients suspected of having influenza; cohort confirmed influenza patients with other patients confirmed to have influenza.
- Wear a surgical or procedure mask when entering the patient's room or when working within 3 feet of the patient. Remove the mask when leaving the patient's room and dispose of the mask in a waste container.
- If patient movement or transport is necessary, have the patient wear a surgical or procedure mask, if possible.

Airborne Precautions

Taken in addition to Standard Precautions

- Prevent spread of infection through very small (< 5 microns) airborne particles
- Examples
 - Tuberculosis
 - Measles
 - *Varicella*
 - *Variola*



The goal of airborne precautions is to prevent transmission of infectious particles less than 5 microns in size that remain infectious while suspended in the air. Examples of these types of infectious diseases include tuberculosis, measles, *Varicella*, and *Variola*. You may recall from earlier in this session that it is unknown whether avian influenza infection can be transmitted among humans this way.

Airborne Precautions

- Use for influenza patients when:
 - History of travel to country with avian influenza activity within 10 days
- AND
- Hospitalized with severe febrile respiratory illness
 - Or are otherwise under evaluation for avian influenza

Airborne precautions should be used for suspected avian influenza patients under the following circumstances:

Patients have a history of travel to a country with avian influenza activity within 10 days and are hospitalized with a severe febrile respiratory illness, or are otherwise under evaluation for avian influenza.

Airborne Precautions

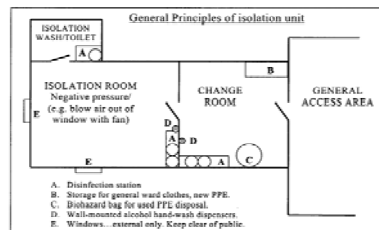
- N95 respirator (or equivalent) for personnel
 - Check seal with each use
- Patient in isolation
- Negative pressure isolation room, if available
 - Air exhaust to outside or re-circulated with HEPA filtration
- Patient to wear a surgical mask if outside of the isolation room

In addition to PPE used for standard precautions, airborne precautions require use of a particulate respirator that is at least as protective as an N-95 respirator. The respirator should be fitted, and the user should check to make sure that the seal is working with *each* use.

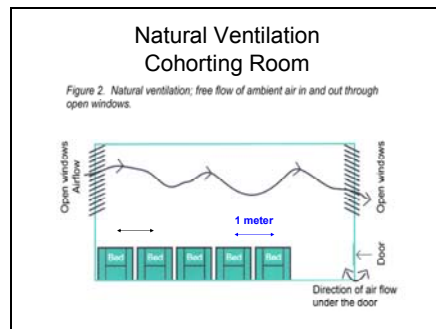
Under airborne precautions, the patient is to stay in isolation. If available, a negative pressure isolation room, if one is available. The air from that room should *not* be re-circulated into the rest of the building; rather, it should be ventilated to the outdoors away from populated areas or recirculated via a high efficiency particulate air (HEPA) filter.

If a patient leaves the isolation room, he or she should wear a surgical mask.

Negative Pressure Isolation Room



This slide shows the layout of a negative pressure isolation room. On the far right side is the hallway or general access area. This leads into a front room or antechamber of the isolation room. The antechamber can be used for changing into the appropriate personal protective equipment, and for monitoring the patient without contacting the patient. This room leads into the isolation room. Both the change room and the isolation room contain disinfection stations for washing hands and using hand-wash alcohol dispensers. This isolation room is negative pressure, so that air is ventilated to the outdoors and not circulated in the rest of the hospital.



This slide shows the ventilation system that might be used if a negative pressure isolation room is not available. Air flows into the room from the outdoors, and flows back out of the room to the outdoors. There should be a door that can be kept closed. If multiple patients are cohorted in the same room, beds should be kept at least one meter apart.

- Aerosol-generating Procedures**
(Example; Endotracheal intubation)
- **N95 particulate respirator**
 - If not available, wear tight fitting surgical mask and face shield
 - **Eye protection**
 - **Gloves and hand washing**
 - **Gown and waterproof apron**
 - **Isolation room with negative pressure, if available**
 - **Hair cover optional**

This slide highlights barrier precautions that you should take for performance of an aerosol-generating procedure such as endotracheal intubation on an avian influenza-infected patient. The overall goal when performing an aerosol-generating procedure is to limit exposure, as there is a high risk of influenza transmission.

Healthcare workers should wear an N95 particulate respirator. If a respirator is not available, workers should wear a tight fitting surgical mask and face shield as an alternative. Workers should also wear eye protection, but hair cover is optional. Hand hygiene and the use of gloves are very important. And in addition to a gown, workers might want to use a waterproof apron over the gown if any splashing with blood or body fluids is anticipated.

It is ideal to perform the aerosol-generating procedure in an isolation room with negative pressure, if available, such as the one that we just illustrated. Otherwise the procedure can be performed in a side room or other closed, single-patient areas. Minimal staff should be present.

Choosing the Appropriate PPE

Next we will touch on which elements of PPE to use in different situations.

Avian Influenza

- Likely large droplet transmission
- Possible airborne transmission
- Recommended PPE varies depending on situation

For avian influenza, the transmission is likely through droplet spread, however airborne transmission has not been ruled out. The choice of PPE therefore depends on several factors, including the likelihood that the person is infected (e.g. different recommendations for a confirmed case v. a person under investigation), the setting (e.g. community v. hospital).

Interviewing - Asymptomatic Exposed Persons and Contacts

- Low-risk activity
- Routine use of PPE not recommended
- Maintain 3 feet distance between interviewer and interviewee
- Use proper hand hygiene
 - May use hand sanitizer (at least 60% alcohol) if hands not visibly soiled

Interviewing people who are asymptomatic and who either may have been exposed, or who are contacts of a suspect or confirmed case, is considered a low-risk activity. The routine use of PPE in this situation is not recommended. Some precautions, however, should be used, such as maintaining 3 feet of distance between interviewer and interviewee, and using proper hand hygiene. Note that if hands are not visibly soiled, a hand sanitizer that is at least 60% alcohol may be used.

Interviewing - Symptomatic Exposed Persons

- Higher risk activity
- PPE recommended in community and healthcare facility
 - Contact precautions
 - Droplet precautions
 - N95 respirator
- In healthcare facility, person should be placed in airborne isolation room

Conducting interviews with persons who have been exposed and who are symptomatic is a higher risk activity. Therefore, the use of PPE recommended in when interviewing these individuals both in the community or in a healthcare facility. Contact and droplet precautions should be used, including an N95 respirator. If they are in a healthcare facility, the exposed person should be placed in airborne isolation room.

**Specimen Collection – Exposed
Persons and Birds**

- High-risk aerosol-generating procedure
- PPE recommended
 - Gloves
 - Gown
 - Goggles or face-shield
 - N95 or better respirator

Collecting specimens either from people or from animals is a high-risk, aerosol-generating procedure. Full PPE is recommended, including gloves, gown, goggles or face-shield, and N95 or better respirator.

**Avian Influenza
Infection Control in
Health Care Facilities**

In this segment of the session, we are going to review avian influenza infection control considerations specific to health care facilities.

Influenza Transmission

Effective Infection Control
Prevents Transmission From
...

- Patients to health care workers
- Patients to patients
- Patients to family members providing care

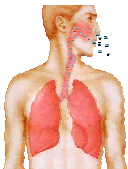


The goal of infection control in health care facilities is to prevent transmission of infectious agents from patients to health care workers, from patients to other patients, and from patients to family members providing care. We will focus on infection control specific to avian influenza.

Currently, avian influenza has not been shown to spread efficiently from person-to-person. However, this could change at any time and we need to be prepared to prevent transmission when it does. The literature suggests there is a need for infection control education in health care facilities. Recent publications have described how health care workers who had been exposed to patients with avian influenza were not using any personal protective gear. Not only are health care workers putting their own health in jeopardy; they are also jeopardizing the health of other patients and the public since no one knows when the virus may become more easily transmissible to humans.

Let's look at some specific precautions that health care workers should implement...

Avian Influenza Precautions



- Standard precautions
- Droplet precautions
- Airborne Precautions

Remember that there are 4 general levels of PPE precautions: standard, contact, droplet, and airborne.

Precautions for Suspected or Confirmed Cases

- Place patient in a negative air pressure room
- To create a negative air pressure room:
 - Install exhaust fan and direct air from inside to an outside area with no person movement
- Place patients in rooms alone
 - Alternative: cohort patients away from other patient care areas with beds > 1 meter apart

Suspected and confirmed avian influenza cases should be placed in a negative air pressure room when this is logistically possible. If the facility has no negative air pressure rooms, you can create one by installing an exhaust fan and directing air from the inside of the room to an outside open area with no person movement.

At a minimum, patients should be placed alone in a room. When single rooms are not available, patients should be cohorted in a well-defined area that is segregated from other patient care areas. Cohorted patient beds should be placed at least 1 meter apart as an effort to prevent infection transmission via respiratory droplets.

Precautions for Suspected or Confirmed Cases

- Limit number of health care workers, family members and visitors
- Designate experienced staff to provide care
- Limit designated staff to avian influenza patient care
- Teach family and visitors to use PPE

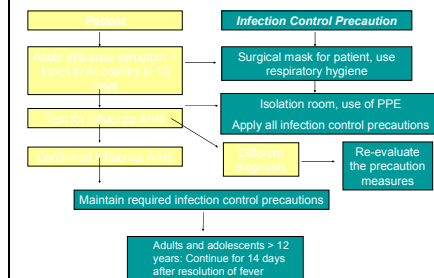
Additional measures to reduce transmission of avian influenza in health care facilities include limiting the number of health care workers, family members and visitors who are exposed to the patient. Health care workers assigned to the patients should be experienced and dedicated to that area – the workers should not staff or visit other patient care areas. Furthermore, family members and visitors should use full barrier precautions when visiting patients.

Precautions for Collecting Specimens

- Notify laboratory in advance
- Health care worker collecting specimen should wear full barrier PPE
- Place specimen in leak-proof bag
- Hand deliver, if possible
- Label specimen clearly as “suspected avian influenza”

Health care workers who collect specimens from avian influenza-infected patients should wear full barrier PPE. Specimens for transport must be placed in leak-proof specimen bags, which have a separate sealable pocket for the specimen (i.e., a plastic biohazard specimen bag). Personnel who transport specimens should be trained in safe handling practices and decontamination procedures in case of a spill. Specimens should be hand delivered where possible. Pneumatic tube systems must not be used to transport specimens that may contain avian influenza virus. The accompanying request form should be clearly labeled as “(suspected) avian influenza” and the laboratory should be notified that the specimen is on the way.

Precautions for Suspected or Confirmed Cases



This diagram summarizes the precautions that should be taken with patients diagnosed at different levels of suspicion of avian influenza. On the left side is the information known about the patient, starting with information about symptoms and poultry contact, moving to testing for influenza A/H5, and then to either confirmed influenza or a different diagnosis. On the right side of the diagram are the infection control precautions that should be taken at each stage of the patient’s assessment. If a diagnosis other than influenza is confirmed, health care workers should re-evaluate precaution measures. If influenza A/H5 infection is suspected or confirmed, then health care workers should apply all required infection control precautions that we have discussed in this session.

Environmental Decontamination

- Cleaning **MUST** precede decontamination
- Disinfectant ineffective if organic matter is present
- Use mechanical force
 - Scrubbing
 - Brushing
 - Flush with water

That's all that we want to cover for working directly with patients. But infection control between patients and other patients, health care workers, and family members are not the only consideration. You must also implement infection control precautions within the health care facility environment.

Environmental decontamination removes pathogens from contaminated surfaces and objects, such as tables, doorknobs, and light switches. The first thing to keep in mind about environmental decontamination is that items and surfaces *must* be cleaned before they can be disinfected. This is because patient secretions, dirt, or any other type of organic matter can inactivate the disinfectant. And to effectively clean surfaces, you must use mechanical force such as scrubbing or brushing and thoroughly flush the surface with water.

Environmental Decontamination: Disinfecting

- | | |
|--|---|
| • Household bleach (diluted) | • Peroxygen compounds |
| • Quaternary ammonia compounds | • Phenolic disinfectants |
| • Chlorine compounds (Chloramin B, Presept) | • Germicides with a tuberculocidal claim on label |
| • Alcohol <ul style="list-style-type: none">– Isopropyl 70% or ethyl alcohol 60% | • Others |

Fortunately, avian influenza is inactivated by a number of disinfectants, including the ones listed here. They include:

- Household bleach solution
- Quaternary ammonia compounds
- Chlorine compounds (Chloramin B, Presept)
- Alcohol
- Isopropyl 70% or ethyl alcohol 60%
- Peroxygen compounds
- Phenolic disinfectants
- Germicides with a tuberculocidal claim on label

Always follow the manufacturer's recommendations when using these or other disinfectants.

Using Bleach Solutions

- First clean organic material from surfaces or items
- Wipe nonporous surfaces with sponge or wet cloth
 - Allow to dry
- Immerse items for 30 minutes
- Use fresh diluted bleach daily!

When you use bleach solutions, remember that organic material must first be cleaned from surfaces or items. If you are going to be wiping nonporous surfaces, use a sponge or wet cloth soaked in the bleach solution to wipe the surface and allow it to dry. To disinfect items by immersing them in a bleach solution, you should leave them immersed for 30 minutes. Place items on a clean, disinfected surface to dry.

Finally, bleach solution should be made fresh *daily* and discarded if unused after 24 hours.

Waste Disposal

- Use Standard Precautions
 - Gloves and hand washing
 - Gown + Eye protection
- Avoid aerosolization
- Prevent spills and leaks
 - Double bag if outside of bag is contaminated
- Incineration is usually the preferred method

Standard precautions should be followed when handling waste from patients infected with avian influenza. This includes practicing hand hygiene and wearing gloves, a gown, and eye protection.

Although the possibility of transmission of avian influenza infection via human feces is unknown, waste should be handled with caution, and any potential aerosolization should be avoided. For example, aerosolization could occur as you remove feces from bedpans, commodes, clothing, or reusable incontinence pads by spraying the items with water.

All waste generated in the isolation room or patient care area should be removed in suitable containers or bags that do not allow for spillage or leakage of contents. One waste disposal bag should be adequate if waste can be placed in the bag without contaminating the outside of the bag. If the outside of the bag becomes contaminated, a second bag should be placed over the first bag (this is called double bagging). If additional bags are not available, clean and disinfect the outside of the bag before removing it from room. When transporting waste *outside of* the isolation room or patient care area, use gloves followed by hand hygiene.

Managing Linens and Laundry

- Use Standard Precautions
 - Gloves and hand hygiene
 - Gown
 - Mask
- Avoid aerosolization – do not shake
- Fold or roll heavily soiled laundry
 - Remove large amounts of solid waste first
- Place soiled laundry into bag in patient room

The final environmental decontamination item that we want to discuss is laundry resulting from the care of an infected patient. People handling laundry or linens of infected patients should also use standard precautions, including practicing hand hygiene and wearing gloves, and wearing a gown and a mask to avoid potential aerosols generated from the laundry.

When preparing to remove laundry from a patient's room, handlers should avoid shaking the laundry and possibly aerosolizing the virus. Heavily soiled linen should be rolled or folded to contain the heaviest soil in the centre of the bundle. Large amounts of solid material (e.g., feces) should first be removed from the linen with a gloved hand and toilet tissue and then placed into a toilet for disposal (close the toilet lid when flushing). Then, place soiled linen directly into a laundry bag in the isolation room or patient care area and contain the linen in a manner that prevents the laundry bag from opening or bursting during transport and while in the soiled linen holding area. When transporting soiled linen and laundry outside of the isolation room or patient care area, also use gloves followed by hand hygiene.

Laundry personnel responsible for the linen cleaning should also use standard precautions and perform hand hygiene after handling personal protective equipment that has been in contact with soiled linen and laundry. Personnel should wash and dry linen according to routine facility standards and procedures.

Avian Influenza Infection Control in the Community

Let's now move on to discuss avian influenza infection control in the *community* setting.

Preventing Transmission in the Community



- Respiratory etiquette
 - Cover nose / mouth when coughing or sneezing
- Hand washing!

We have just discussed infection control measures in health care facilities to prevent patient to health care worker and patient to patient transmission of avian influenza. Next we will discuss how to prevent person to person spread of avian influenza in the *community*.

Specific infection control policies and procedures may be easier to implement in a controlled environment such as a medical facility, but good infection control practices can also be adapted to prevent and control respiratory disease transmission in the community. The following measures to contain respiratory secretions are recommended for all individuals with symptoms of a respiratory infection such as avian influenza:

- Cover the nose and mouth with a mask, tissue or cloth when coughing or sneezing, and dispose of the tissue in the nearest waste receptacle after use.
- If a mask, tissues or cloth are not available, cough or sneeze into your upper sleeve versus your hands.
- Perform hand hygiene (e.g., hand washing with non-antimicrobial soap and water, alcohol-based hand rub, or antiseptic hand wash) after having contact with respiratory secretions or contaminated objects.

Avian Influenza and Food

- Heat to $> 70^{\circ}\text{C}$ to kill the avian influenza virus
- Consumption of any raw / undercooked poultry ingredients is risky
 - Runny eggs
 - Meat with red juice
- Separate raw meat from cooked or ready-to-eat foods to avoid cross-contamination
- Wash hands before and after preparing food

There is a good chance that you may be asked about food safety and avian influenza. The good news is that so far, there isn't any evidence that avian influenza can be spread through eating food that has been properly cooked above 70°C in all parts of the food item. However, there *have* been several reports of transmission through consumption of dishes containing raw, contaminated poultry blood. For this reason, consumption of any raw poultry ingredients is risky and should be discouraged. This practice also protects people against other diseases spread through raw or undercooked poultry.

Eggs that have a runny center or meat that has red juice are undercooked. Eggs from areas with avian influenza outbreaks in poultry should only be eaten if they are thoroughly cooked. Raw meat should be separated from cooked or ready-to-eat foods to avoid cross-contamination.

Finally, refrigeration and freezing do not kill the virus, so it is important to wash your hands when handling frozen or thawed raw poultry meat, and before and after preparing food.

Patients Cared for at Home

- Potential for transmission!
- Must educate family caregivers
- Fever / symptom monitoring
- Infection control measures
 - Hand washing
 - Use of available material as PPE

As with any infectious disease, there is the potential for avian influenza to be transmitted in the home. Therefore, people within the home of an infected individual should be educated on the risk for transmission, and ideally wear personal protective equipment including gloves, gowns and surgical masks. If PPE items are unavailable, readily available materials such as tissues or cloths should be used. Hand hygiene, as always, is critically important in preventing the spread of avian influenza in the home. Finally, as will be discussed in a moment, anyone handling corpses should wear protective gear.

Patients Cared for at Home

- Handle laundry with gloves; do not shake to prevent aerosolization
- Use disposable or dedicated dishes, utensils
- Decontaminate the home environment
 - Frequent cleaning before disinfection

Standard precautions should be used when handling laundry and dishes of suspected or confirmed avian influenza patients in the home. As in a medical facility, soiled laundry should be treated carefully to prevent aerosolization of the virus. A thorough washing with soap and preferably warm water is sufficient to decontaminate laundry. Dedicated dishes should be used for the patient.

Also, decontamination of the home would be necessary if a person infected with avian influenza were living there. Recall from our discussion about environmental decontamination in health facilities that it is crucial to clean any organic material before disinfection, or the organic material may inactivate the disinfectant. Disinfectants such as household bleach or 70% alcohol are probably the most readily available for home use. And remember that anyone performing environmental cleaning or disinfection should wear PPE to protect themselves from contracting the disease while cleaning.

Decontamination of Dishes and Eating Utensils

- Use disposable items when available
- Wash with detergent and hot water
 - Wear rubber gloves

Persons handling dishes and eating utensils of infected patients should observe standard precautions, such as wearing rubber gloves. Reusable items should be washed in a dishwasher with detergent at the recommended water temperature, when possible. If a dishwasher is unavailable, detergent and hot water should be used to wash items. Wear rubber gloves if washing items by hand.

Precautions for Handling Corpses

- Mortuary staff should use Full Barrier PPE
- Anyone handling a corpse infected with avian influenza should be informed

Funerals for people who have died from avian influenza infection can be a sensitive issue that requires consideration of religious and cultural practices. It is often important for families to conduct funerals and burials according to their own customs. This can probably be allowed while still protecting family members from being infected by the deceased person.

In the case of avian influenza, anyone involved in handling a corpse should be informed that the deceased was infected. If the person died at home and the corpse is being managed inside the home, Full Barrier PPE (Standard, Contact, and Airborne protection plus eye protection) should be used by those coming into the home to manage the corpse. Once the body is out of the home, persons managing the corpse (for example, the mortuary staff) should use standard precautions to avoid unprotected contact with blood, body fluids, secretions or excretions.

Application of Infection Control Activities during an Investigation

In this last segment of the session, we will synthesize what you have learned and discuss how to apply infection control activities during an avian influenza investigation.

Location Influences Actions

- Medical facilities
- Homes
- Farms
- Markets
- Rural versus Urban areas

The location of the investigation will be important to consider for your infection control preparations. For example, will the investigation take place in a medical facility, such as a hospital or clinic? Or, will the team make home visits? Will you visit any animal-raising areas such as farms? Will you visit markets? Finally, will the investigation take place in a rural or urban area?

Anticipate Exposures

Contact with. . .

- Infected individuals
- Individuals suspected to be infected
- Potentially contaminated substances
- Potentially contaminated surfaces / items
- High-risk procedures
- Animals

You will also need to anticipate what types of exposures you may encounter during the investigation. For example, will you interact with individuals who have been diagnosed with the illness? With individuals who are *suspected* of having the illness? Might you come into contact with a potentially contaminated environment? Will you be involved in any high-risk medical procedures? Might you handle corpses or potentially infected animals?

The answers to these questions will help you determine which infection control precautions and PPE you will need to implement or use to protect yourself and your team members from contracting and spreading the disease.

Assess Existing Infection Control Infrastructure

- Policies and procedures
- Authority
- Human resources
- Financial resources
- Engineering resources

Next, you will need to assess the existing infection control infrastructure within the investigation environment. While it would be ideal to do this *before* embarking on the investigation, it usually occurs as soon as the team arrives. The components of infection control infrastructure are: policies, procedures, authority, and human, financial, and engineering resources.

Assess Existing Infection Control Infrastructure

- Do policies describe PPE for health care workers?
- Are procedures in place for patient room cleaning?
- Are there negative air pressure rooms?
- Will you need to promote respiratory and hand hygiene in the community?

When assessing infection control infrastructure during an avian influenza investigation, some questions will be specific to avian influenza. For example:

- Are there policies in place that detail PPE for health care workers?
- Are there procedures in place for patient room cleaning?
- Are there negative air pressure rooms available? If not, are patients being cohorted?
- Will you need to promote respiratory and hand hygiene in the community?

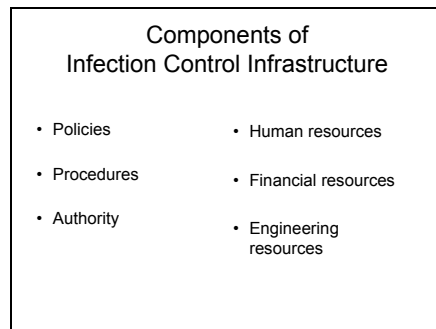
Assessing Infection Control Needs During an Investigation

Let's now focus on how to assess infection control needs during an investigation.

Overview

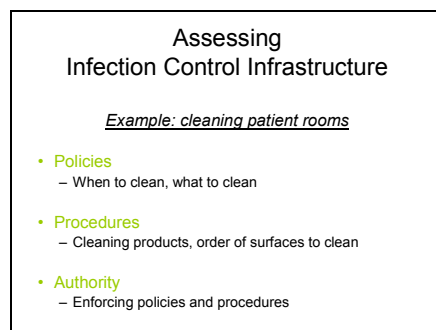
- Components of infection control infrastructure
- Infection control in healthcare facilities
- Infection control in the community

In this segment of the module we will cover the components of an infection control infrastructure, infection control in healthcare facilities, and infection control in the community.



There are several infection control components that need to be in place in order to implement an effective program. Infection control programs can be used to control the spread of *all* infectious agents, in medical facilities, in the community, and during investigations. While the details will vary depending on the situation, several components of infection control infrastructure are needed regardless of the location or the specific infectious agent.

An infection control program needs policies and procedures to be followed, as well as the authority to enforce them. Human, financial, and engineering resources are also instrumental.



Let's use an example of cleaning patient rooms to illustrate the application of the components of infection control infrastructure. The first component needed is a policy for cleaning patient rooms. Details such as when each room must be cleaned and what surfaces and items should be cleaned might be included in the policy. Next, a procedure describing *how* to clean patient rooms is needed. This might include the type of cleaning product to be used and the order in which surfaces or other items should be cleaned. Now, what if, for some reason, the rooms were not being cleaned properly or even at all? Infection control personnel would need the authority to work with hospital administrators so that the cleaning policy could be enforced.

Assessing Infection Control Infrastructure

Example: Cleaning patient rooms (continued)

- Human resources
 - Staff to clean rooms
- Financial resources
 - Money to buy cleaning products
- Engineering resources
 - Cleaning equipment
 - Hand hygiene facility (sink)

Continuing our example for the resource components of infection control infrastructure, staff would be needed to clean the rooms and money would be needed to buy cleaning products. Examples of engineering resources include having cleaning equipment and a hand hygiene facility such as a sink for the staff to wash their hands after cleaning patient rooms.

Sustainability

- Evaluate infection control knowledge
- Evaluate infection control procedures
- Develop a sustainable program
- Encourage routine practice
- Build local capacity

In addition to assessing the infection control infrastructure, you should assess the infection control program's *sustainability* since infection control is always needed whether or not an outbreak is occurring. The first step to building a sustainable infection control program is evaluating the general level of infection control knowledge and existing practices among health care staff. Determine which practices are effective, which ones are ineffective, and any remaining ones that need to be implemented. Then, use this insight to help staff develop an effective infection control program. Part of making an effective infection control program sustainable is having staff practice procedures daily so they can be effective under the stress of an outbreak. Be sure to correct errors if and when you see them.

Building local capacity for a sustainable infection control program in this way will help you prevent and control *all* infectious diseases.

Sustainability Example

- Hospital outside a large city
- Has basic infection control program
- You notice healthcare personnel
 - Recapping needles
 - Not wearing eye protection when doing invasive procedures
- Help staff develop appropriate policies and procedures

Now let us consider a scenario in which you are called to a hospital outside of Chicago, Illinois to help build their infection control program in response to increasing numbers of influenza cases. The hospital has a basic infection control program. However, when you visit the site, you observe health care personnel recapping used needles and failing to wear eye protection when performing invasive procedures on different patients.

Although these issues may not always be directly relevant to the hospital's avian influenza infection control, you recognize that they are ineffective infection control practices in general. It would greatly benefit the staff and patients at the hospital if you took the opportunity to correct these mistakes, educate the staff, and help the staff develop relevant policies and procedures to be followed in the future.

Authority

- Communication with various administrative levels
- Policies may already exist
 - National
 - Regional
 - Local
- Adapt to the facility you are working in

We have talked about needing the authority to enforce infection control measures in the facility or community. But this infrastructure also includes the need for authority to communicate with various administrative levels. For example, there may be national, regional and/or even local infection control policies that you will need to incorporate into the facility you are working in.

How to Put on and Remove Personal Protective Equipment

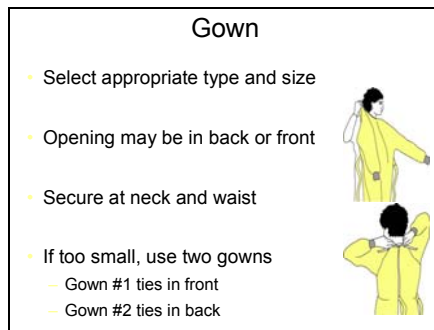
Since a large part of infection control is knowing when and how to use personal protective equipment, we will revisit the topic to discuss how to safely don and remove PPE.

Sequence for Donning PPE

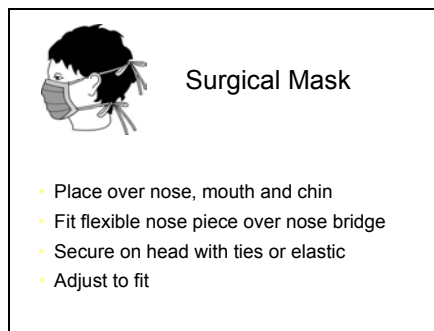
1. Wash hands
2. Gown
3. N95 Particulate respirator
 - Perform seal check
4. Hair cover
5. Goggles or face shield
6. Gloves

This next segment will address the sequence of donning and removing PPE, specifically when caring for patients with suspected or confirmed avian influenza.

Before donning PPE, always perform hand hygiene practices. The gown should be donned first. The respirator should be put on next and properly adjusted to fit; remember to fit check the respirator. If you will be involved in an aerosol-generating procedure, you may choose to wear a hair cover. The goggles or face shield should be donned next, and the gloves are donned last.



To don a gown, first select the appropriate type for the task and the right size for you. Some gowns open in the back while others, such as Tyveks, open in the front. Secure the gown at the neck and waist. If the gown is too small to fully cover your torso, use two gowns. Put on the first gown with the opening in front and the second gown over the first with the opening in the back.



Some masks are fastened with ties, others with elastic. If the mask has ties, place the mask over your mouth, nose and chin. Fit the flexible nose piece to the form of your nose bridge. Tie the upper set at the back of your head and the lower set at the base of your neck.

If a mask has elastic head bands, separate the two bands, hold the mask in one hand and the bands in the other. Place and hold the mask over your nose, mouth, and chin, then stretch the bands over your head and secure them comfortably as shown; one band on the upper back of your head, the other below the ears at the base of the neck.

Adjust the mask to fit. Remember, you don't want to be touching it during use, so take the few seconds needed to make sure it is secure on your head and fits snugly around your face so there are no gaps.

N95 Particulate Respirator

- Pay attention to size (S, M, L)
- Place over nose, mouth and chin
- Fit flexible nose piece over nose bridge
- Secure on head with elastic
- Adjust to fit and check for fit:
 - Inhale – respirator should collapse
 - Exhale – check for leakage around face



The technique for donning a particulate respirator, such as an N95, N99 or N100, is similar to putting on a pre-formed mask with elastic head bands. First, note which size you have. Then place the respirator over the nose, mouth, and chin. Fit the flexible nose piece securely over the bridge of your nose, secure the mask onto your head with elastic, and adjust the elastic to fit.

With N95 and other particulate respirators, however, you must select a respirator for which you have been fit tested and you must fit-check the device before entering an area where there may be airborne infectious disease. To fit-check a respirator, inhale and the respirator should collapse. When you exhale, check for air leaking around the mask on your face.

Be sure to follow the manufacturer's instructions for donning the device. In some instances, the manufacturer's instructions may differ slightly from this presentation.

Eye and Face Protection

- Position goggles over eyes and secure to the head using the ear pieces or headband
- Position face shield over face and secure on brow with headband
- Adjust to fit comfortably

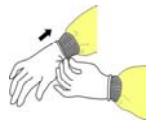


If eye protection is needed, either goggles or a face shield should be worn. Position goggles over your eyes and secure them to the head using the ear pieces or the headband. Adjust the equipment so it fits comfortably. Goggles should feel snug but not tight.

For a face shield, position it over the face and secure it to your brow or forehead with the headband. Adjust the equipment so it fits comfortably.

Gloves

- Don gloves last
- Select correct type and size
- Insert hands into gloves
- Extend gloves over gown cuffs



Finally, we will discuss gloves. Gloves will be the *last* PPE item that you don when preparing to work with a patient. Be sure to select the type of glove needed for the task in the size that best fits you. To review from earlier in the session, thick rubber gloves may be used for cleaning or housekeeping purposes in a patient's room. Clean gloves might be used for general contact in the room or with the patient, while sterile gloves should be used when collecting specimens or conducting any type of medical procedure on the patient.

Insert each hand into the appropriate glove and adjust the gloves as needed for comfort and dexterity. If you are wearing an isolation gown, tuck the gown cuffs securely under each glove. This will provide a continuous barrier protection for your skin.

Key Infection Control Points

- **Minimize exposures**
 - Plan before entering room
- **Avoid adjusting PPE after patient contact**
 - Do not touch eyes, nose or mouth!
- **Avoid spreading infection**
 - Limit surfaces and items touched
- **Change torn gloves**
 - Wash hands before donning new gloves

Even once PPE is donned, you still need to be sure that you employ safe work practices. These include minimizing exposures; it may help to think through how you will work within the patient's environment before you enter his or her room. Once you have had patient contact, it is critical that you avoid contaminating yourself by keeping your gloved hands away from your face. For example, do not touch or adjust PPE after you have had contact with the patient or the patient's room. You can also avoid spreading contamination by limiting the number of surfaces and items that you touch with contaminated gloves. Finally, always remove gloves that become torn, and perform hand hygiene before putting on a new pair.

Duration of PPE Use

Surgical Masks (if N95 not available)

- Wear once and discard
- Discard if moist

N95 Particulate Respirators

- May use just one with cohorted patients

Eye Protection

- May wash, disinfect, reuse

In addition to knowing what to wear, how and when to wear it, and how to take precautions while wearing PPE, you should also know some general guidelines for the duration of use for certain types of PPE.

When wearing surgical masks, wear them once and then discard them. If a mask becomes moist while you are wearing it, discard it and use a new one.

If avian influenza-infected patients are cohorted in a common area or in several rooms on a nursing unit, and multiple patients will be visited over a short time, it may be practical to wear one respirator for the duration of the activity.

You may wash, disinfect, and *reuse* eye protection.

Sequence for Removing PPE

Remove in anteroom when possible

1. Untie gown and remove shoe covers
2. Gloves
3. Wash hands
4. Gown (**and apron, if worn**)
5. Goggles
6. Mask
7. Cap (**if worn**)
8. Boots
9. Wash hands

The sequence for removing PPE is intended to limit opportunities for self-contamination; the exact order is not as important as limiting contamination, so you can change it if necessary.

Ideally, PPE should be removed in the anteroom. If there is no anteroom, make sure that the environment (and people) outside of the isolation room are not at risk of contamination. If you are wearing a gown that is tied in front, untie the gown (but do not remove) and remove shoe covers. Next, remove gloves, discard them, and then wash your hands. Next remove the gown, and apron, if you are wearing one. Then remove goggles, mask, and cap (if worn) and place those items in appropriate containers. Always use your health care facility's protocol for any items that need to be discarded. The last item to remove will be any boots that you are wearing. Place those in an appropriate container. You will then wash your hands for a second time, this time up to the wrists, with soap and water, and dry them. The final step is to decontaminate your hands using a 70% alcohol hand rub before you leave the facility.

Removing Gloves (1)

- 
- Grasp outside edge near wrist
 - Peel away from hand, turning glove inside-out
 - Hold in opposite gloved hand

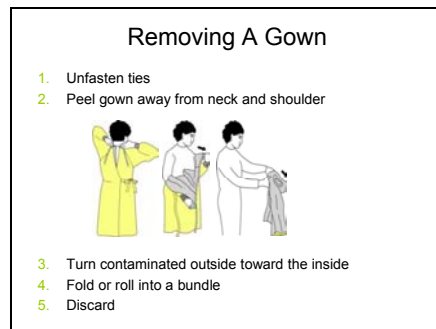
Now let's focus on how to safely remove each piece of personal protective equipment in a way that you avoid contaminating yourself, others, or the environment. We will begin with gloves.

Using one gloved hand, grasp the outside of the opposite glove near the wrist. Pull and peel the glove away from the hand. The glove should now be turned inside-out, with the contaminated side on the inside. Hold the removed glove in the opposite gloved hand.

Removing Gloves (2)

- 
- 
- Slide ungloved finger under the wrist of the remaining glove
 - Peel off from inside, creating a bag for both gloves
 - Discard

To remove the second glove, slide one or two fingers of the ungloved hand under the wrist of the remaining glove. Peel the glove off from the inside, creating a bag for both gloves. Discard the gloves in an appropriate waste container per your health care facility's protocol.



After removing gloves, you can safely remove the isolation gown. Unfasten the gown ties (for a gown that ties in the back) with your ungloved hands. Slip your hands underneath the gown at the neck and shoulder, and peel the gown away from the shoulders. Slip the fingers of one hand under the cuff of the opposite arm. Pull the hand into the sleeve, grasping the gown from inside. Reach across and push the sleeve off of the opposite arm. Fold the gown towards the inside and fold or roll it into a bundle (only the “clean” inside part of the gown should be visible). Discard the gown into a waste or linen container, as appropriate.



After you remove your gown, you can remove eye protection. Using ungloved hands, grasp the “clean” ear or head pieces and lift the eye protection equipment away from your face. If the goggles or face shield are reusable, place them in a designated receptacle for cleaning and disinfecting. Otherwise, dispose of them in the appropriate waste receptacle.

Removing a Mask

- Lift the bottom elastic over your head first
- Then lift off the top elastic
- Discard
- Don't touch front of mask



The process for removing a particulate respirator is similar to that for a mask. Lift the bottom elastic over the head first. Then remove the top elastic. This should be done slowly to prevent the respirator from “snapping” off of the face. As you discard the mask, avoid touching the front of it.

If You MUST Reuse PPE..

- Use during one shift and for one patient
- Discard at the end of each shift

GOWN

- Hang gown with outside facing in

MASK OR RESPIRATORS

- Put the mask into the sealable bag
- May touch the front of the mask, but wash hands immediately after removing

We have learned so far how to remove the PPE when you are only using it one time. However, if you have limited resources, you may need to reuse it. If the PPE must be reused, it should be reused during one shift for one patient and discarded at the end of each shift. The technique for removing then will be different from what we have learned. For the gown, hang it with outside facing in. To reuse the mask or respirators, you may need to touch the front of the mask. In this situation, you need to wash your hands immediately after removing the mask. Put the mask into a sealable bag; do not put it in your pocket.

Hand Washing

- Between PPE item removal, if hands become visibly contaminated
- Immediately after removing all PPE
- Use soap and water or an alcohol-based hand rub

Hand hygiene is the most effective way to prevent the spread of infection. If your hands become visibly contaminated *during* PPE removal, you should wash them before continuing to remove PPE. Once you have completed removing all pieces of personal protective equipment, you should perform hand hygiene immediately. Wash your hands thoroughly with soap and warm water or, if hands are not visibly contaminated, use an alcohol-based hand rub.

Summary

- Influenza transmission occurs mainly through respiratory droplets
 - Contact can be prevented using PPE
 - Virus can be inactivated with infection control procedures
 - Hand washing is key
- PPE must be donned and removed appropriately to prevent contamination of wearers and environments
- Guidelines for using PPE and infection control measures for avian influenza in humans should be practiced until they are routine

In summary, one of the best ways to prevent influenza infection is to prevent transmission. Influenza transmission occurs through respiratory droplets, but contact with these droplets can be prevented when health care workers wear personal protective equipment. Additionally, the virus can be inactivated with infection control procedures such as environmental decontamination.

Personal protective equipment must be donned and removed appropriately to prevent contamination of the wearer or the environment.

And finally, specific guidelines for infection control measures for avian influenza in humans, including protocol for donning and removing PPE, should be followed as closely as possible.

Glossary

Decontamination - The removal of harmful substances such as chemicals, harmful bacteria, or other organisms, from exposed individuals, rooms, and furnishings in buildings or in the outside environment.

Disease transmission - The process of the spread of a disease agent through a population

Infection control - Measures practiced by health care personnel in health care facilities to prevent the spread of infectious agents

Personal protective equipment - Specialized clothing or equipment worn by a worker for protection from a hazard

Decontamination – The removal of harmful substances such as chemicals, harmful bacteria, or other organisms, from exposed individuals, rooms, and furnishings in buildings or in the outside environment.

Disease transmission - The process of the spread of a disease agent through a population.

Infection control - Measures practiced by health care personnel in health care facilities to prevent the spread of infectious agents.

Personal protective equipment - Specialized clothing or equipment worn by a worker for protection from a hazard.

References and Resources

- Avian influenza, including influenza A (H5N1), in humans: WHO interim infection control guideline for health care facilities Revised 24 April 2006.
http://www.who.int/csr/disease/avian_influenza/guidelines/infectioncontrol/en/index.html
- Practical Guidelines for Infection Control in Health Care Facilities. SEARO Regional Publication No. 41; WPRO Regional Publication, 2004.
http://w3.whosea.org/LinkFiles/Update_on_SEA_Earthquake_and_Tsunami_infection-control.pdf
- US Centers for Disease Control and Prevention. "Cover Your Cough" <http://www.cdc.gov/flu/protect/covercough.htm>
- Elizabeth A. Bolyard, et al. Centers for Disease Control and Prevention. Guideline for infection control in health care personnel, 1998.
<http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/infectControl98.pdf>

Module 4

Investigation of Poultry on a Farm

Presentation Handouts

Exercises

Investigation of Poultry on a Farm

Presentation Handouts

Highly Pathogenic Avian Influenza (HPAI) on the Poultry Farm

In this module, we will discuss the transmission of highly pathogenic avian influenza on the poultry farm, including some guidelines for occupational exposure.

Learning Objectives

- Describe normal transmission of Influenza A
- Describe development of HPAI (vs. LPAI)
- Describe control measures
 - Surveillance
 - Enhanced biosecurity
 - Movement control
 - Destruction of contaminated birds and fomites
 - Role of vaccines and antivirals

The learning objectives for this module are to:

- Describe normal transmission of Influenza A
- Describe development of highly-pathogenic avian influenza, or HPAI, versus low-pathogenic avian influenza, or LPAI
- Describe control measures
- Surveillance
- Enhanced biosecurity
- Movement control
- Destruction of contaminated birds and fomites
- Role of vaccines and antivirals

Session Overview

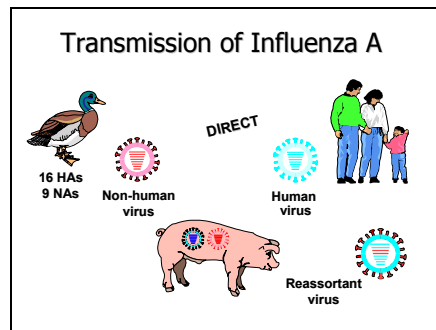
- Influenza transmission basics
- Influenza infection in wild and domestic birds
- Sources of infection on the farm
- Surveillance
- Biosecurity measures
- Guidelines for poultry-related occupations

We will start the session with a very brief review of influenza transmission basics. We will then discuss influenza infection and transmission among wild and domestic birds. We will talk about sources of infection for animals and humans on the farm, and then we will touch on surveillance, biosecurity measures, and guidelines for poultry related occupations.

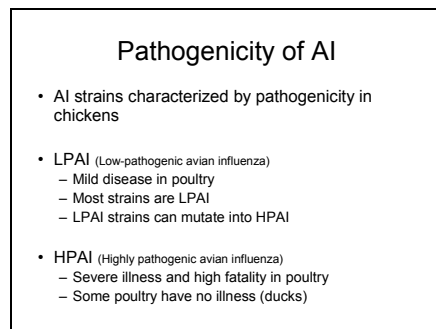
Influenza A

- Infects multiple species
 - Humans
 - Water fowl (primary reservoir) and domestic fowl
 - Pigs (mixing vessels)
 - Other mammals affected by certain sub-strains (horses, dogs, cats, tigers, etc)

Of the three types of influenza, Type A influenza is the greatest cause for concern from a public health standpoint. Influenza A (unlike B and C) can infect a wide variety of animals, most notably free-flying fowl, which are considered to be the natural reservoir. This gives the virus an extremely mobile, genetically diverse pool of hosts. Influenza A also has the ability to infect mammals such as humans and pigs (and some others such as horses, dogs, cats, tigers, ferrets, and seals). Therefore, it has access to new types of HA and NA genes with which to mix. Pigs are of particular interest, since they have receptors in their respiratory tract for both human and avian influenza proteins. Thus, they are considered the “mixing vessels” for influenza A. If a pig becomes infected with both an avian and a human influenza virus, gene swapping can occur and give rise to a new subtype that is potentially more pathogenic than the normal circulating subtypes.



This slide gives a graphic representation of how mixing among the subtypes of influenza A virus can happen. Pigs can be infected by avian, swine, and human influenza A viruses. Pigs, therefore, can play a critical role in genetic reassortment of the virus. If a pig respiratory tract cell were to be coinfecting by an avian and human influenza A virus, reassortment of gene segments could occur. This would result in a novel, hybrid influenza virus, part avian and part human. The resulting novel subtype would be something that had not been “seen” before by (specifically) human immune systems, thus giving rise to a potential pandemic virus. The mixing of humans, pigs and fowl is of particular concern in areas where livestock are raised together and allowed to mingle with human caretakers.



Avian influenza A virus strains are further classified as low pathogenic (LPAI) or highly pathogenic (HPAI) on the basis of specific molecular genetic and pathogenesis criteria that require specific testing. Most avian influenza A viruses are LPAI viruses that are usually associated with mild disease in poultry. In contrast, HPAI viruses can cause severe illness and high mortality in poultry. More recently, some HPAI viruses (e.g., H5N1) have been found to cause no illness in some poultry, such as ducks. LPAI viruses have the potential to evolve into HPAI viruses and this has been documented in some poultry outbreaks.

Development of HPAI

- Low pathogenic AI strains that are most capable of mutating into HPAI and causing epizootics
 - H5 and H7
 - Most H5 and H7 are LPAI
- Disease
 - Human HPAI infection via contact with infected sick or dead birds
 - Mild human LPAI infections have been documented
- Wild birds can introduce LPAI into domestic flocks
 - Can evolve into HPAI
 - Aggressive intervention required for LPAI

The low-pathogenic strains of avian influenza that are most capable of mutating into highly pathogenic strains are the H5 and H7 subtypes. Most H5 and H7 virus are LPAI. These are the subtypes that have historically proven to cause the most poultry deaths, and can cause human infections, typically when humans have direct contact with infected sick or dead birds. Human illness due to infection with LPAI viruses has been documented, including very mild symptoms (e.g., conjunctivitis) to influenza-like illness. Human infection with highly pathogenic viruses have ranged from mild to severe and fatal disease, depending on the strain.

Highly pathogenic subtypes can arise from mutations that can occur when a mild form of influenza (LPAI) carried by a wild bird is introduced into poultry. Through rapid evolution in the domestic poultry host, the previously stable virus becomes increasingly lethal. This makes the rapid detection of these subtypes of the utmost importance. If a mild virus of this type could be detected at an early stage, elimination or intervention should be possible in domestic poultry. The importance of early detection cannot be overstated, as once the virus mutates into a more lethal form, not only could it cause pandemics in poultry (possibly leading to human infection), it can also take years to completely clear the virus from a particular geographic area.

Signs of LPAI Influenza in Birds

- Wild waterfowl, gulls, shorebirds are natural hosts for influenza viruses
 - Usually no symptoms
- Infection in non-reservoir can result in either:
 - No outward disease (LPAI)
 - Mild infection (LPAI)
 - Ruffled feathers
 - Reduced egg production
 - Respiratory symptoms
 - Can be easy to miss!

Now that we know the way that influenza can become so virulent, we need to examine what to look for in potentially infected animals, particularly birds.

As the natural hosts of all types of influenza viruses (not just the HPAI), wild waterfowl are able to carry the virus with no apparent ill effects. Any domesticated fowl that come into contact with these viruses can easily become infected. Birds infected with LPAI will either develop no outward illness, or a mild form, characterized by mild respiratory signs, ruffled feathers and reduced egg production. This can be easy to miss, and, with some rural farmers, even expected at certain times of the year. Or, infection can lead to (next slide)

Signs of HPAI Infection in Birds

- Causes more lethal infection
 - Difficult to miss - severe disease/sudden onset
 - Facial edema, swollen and cyanotic combs and wattles, drastic decline in egg production
 - Internal hemorrhaging of lungs and other organs
 - Rapid contagion
 - Mortality near 100% within 48 hours
- Role of domestic ducks in spread of HPAI
NO SYMPTOMS!

more lethal disease with severe symptoms of the respiratory tract. Visible signs include facial edema, swollen and cyanotic combs and wattles, and drastic decline in egg production. Disease culminates in internal hemorrhaging of the lungs and other organs within 48 hours. The mortality rate of these types of infections can approach 100% and would be difficult to miss.

The most alarming development thus far in the spread of the most virulent strains of influenza is that domestic ducks can carry one of the lethal strains (H5N1) while appearing perfectly healthy. These domestic ducks would usually show symptoms when infected with an influenza virus. The fact that domestic ducks can be asymptomatic carriers is cause for concern because domestic ducks can silently transmit HPAI to chickens and other domestic poultry in their feces and respiratory secretions.

Avian Influenza in other Animals

- Domestic and wild birds
 - Ducks, geese, sparrows, poultry, pets
- Pigs, horses, marine mammals, ferrets, minks
 - Natural infection contracted from exposure to birds
- Tigers, leopards, domestic cats, dogs
 - Ingestion of infected poultry



In addition to humans and birds, infection with avian influenza has been documented in other species. Bird species include ducks, geese, sparrows, poultry, and pet birds.

Other species that can be infected include pigs, horses, marine mammals, ferrets, and minks, who acquire infection through natural exposure to birds in their environment.

Tigers, leopards, domestic cats, and dogs have also been shown to have contracted the H5N1 virus through ingestion of infected poultry. As a public health concern, domestic animals such as cats and swine could be epidemiologically important for mixing and / or spreading virulent viruses.

The focus in this training has been on infection in birds because of their role in transmission as we currently understand it. Of particular concern for HPAI at this time, is the role of ducks, as we mentioned earlier, that may become asymptotically infected and spread the virus to other birds.

Sources of Infection

- Feces
- Respiratory secretions
- Improper disposal of carcasses



Infection in waterfowl and other fowl mainly occurs through infected feces or respiratory secretions (direct contact).

Other than direct contact with infected birds and their feces, sources of infection for animals can include carcasses that have been disposed of improperly. Burial, burning and composting are considered to be the best methods of disposal, to minimize potential for spread of infection. Once infected or potentially infected birds are humanely euthanized, disposal of carcasses should be rapid and complete.

Potential Sources of Infection for Humans

- Humans
Hands, hair, clothing, footwear
- Contaminated equipment



Investigators must practice biosecurity when entering / leaving a potentially contaminated farm

Humans who are exposed to avian influenza viruses can become infected, but they may also carry influenza virus on their hands, hair, clothing, or shoes, after working with infected poultry. They can then carry these viruses off the poultry farm and expose the people they interact with. Occasionally, transmission can occur through contact with the virus on fomites (clothing, shoes, equipment) or through airborne particles.

Similarly, farming equipment can become contaminated with avian influenza virus. If the equipment leaves the farm and is not cleaned, the virus can be spread to the next people who use that equipment.

Investigators entering and leaving farms that have suspected or confirmed avian influenza must be vigilant in performing biosecurity measures such as wearing personal protective equipment, disposing of potentially contaminated PPE, and cleaning any objects leaving the farm, such as shoes, car tires, etc.

Measures for Prevention, Control and Eradication of HPAI in Poultry

- Increased disease surveillance in high risk areas
- Increased biosecurity on poultry farms
- Control of movement of birds and fomites
- Rapid, humane destruction of infected and at risk poultry and proper disposal of carcasses

Just knowing how a virus can be spread is not enough, however. We are also interested in how to prevent, control and eradicate a potentially lethal virus from a poultry operation or region that is affected. US poultry farms have experience dealing with outbreaks of influenza, including LPAI and HPAI. First, increased disease surveillance will help rapidly detect the emergence of the virus in domestic and wild populations. We must also enforce biosecurity measures, particularly at poultry farms and associated premises, to prevent wild birds from mixing with domestic birds, and to contain the virus should it emerge among flocks. If the virus emerges, control of movement (shipping, etc) of birds that are infected or potentially infected (i.e. exposed to the virus) must be severely limited, and controls instituted at check points between infected and non-infected areas. Once infection has been established, measures must be taken to properly dispose of infected or exposed carcasses, after targeted animals have been humanely euthanized.

Finally, the use of vaccination of animals and/or anti-viral drugs in humans must be considered in the prevention of disease and treatment of disease.

Disease Surveillance

- H5 diagnosis is reportable to USDA
- Conduct in areas where disease has been or could be
- Detect and investigate outbreaks
 - Education on symptoms (esp. rural farmers)
 - How to report / who to report to
 - Incentives for reporting

The first step in controlling any possible HPAI strain that may arise is to increase disease surveillance among poultry in areas that are potentially at risk for outbreaks. Any farm that receives a laboratory test result confirming an H5 virus should report this result to the State Veterinarian; the result will also be reported to USDA.

There are areas that have been vulnerable to infection of HPAI in the past. Surveillance should start there, but also include areas that are at high risk, even if no disease has ever been reported. The people in public health and agricultural occupations- down to the level of the rural farmer- should be educated about symptoms and how to report any anomalies. Also consider giving any possible incentives for reporting.

Disease Surveillance

- Enable animal health agents/rapid surveillance and response teams to:
 - Investigate and record key information
 - Get specimens
 - Send specimens rapidly to a designated laboratory in a “reverse cold chain”



Rapid reporting and investigations into die offs would enable animal health agents to record key information concerning the first signs of an outbreak. Investigators should also be able to quickly obtain specimens, and have access to proper equipment, for analysis in designated laboratories. This would allow them to send these specimens in a “reverse cold chain” that would ensure proper handling and preservation of specimens collected in the field.

Increasing Biosecurity

- All the measures taken
 - to keep disease from coming into a farm (Bioexclusion)
 - to prevent the transmission of a disease within an infected farm and to other farms (Biocontainment)

Infection that arises from poultry farms can be prevented from spreading into the larger community through biosecurity. Biosecurity describes all the measures that can or should be taken to keep disease from coming into a farm, and to prevent the transmission of a disease within an infected farm and to other farms.

Types of Poultry-Raising & Biosecurity

- Sector 1**
 - Backyard poultry
 - Birds/products consumed locally
- Sector 2**
 - Low to minimal bio-security
 - Birds/products enter live bird markets
- Sector 3**
 - Moderate to high bio-security
 - Birds/products often marketed commercially
- Sector 4**
 - High level bio-security
 - Birds/products marketed commercially



When we speak about biosecurity, we are particularly targeting commercial poultry farmers.

There are several different methods of raising poultry, all of which occur in the United States.

First, there is backyard poultry production. These producers range from families who essentially keep poultry as pets to farmers who keep small numbers of birds for personal or limited use. They have minimal or nonexistent biosecurity. Birds or bird products are usually consumed locally.

Also, occasionally birds are raised for cock-fighting. This is done on a small scale, in someone's backyard, and biosecurity measures are nonexistent.

Next, there are commercial poultry production systems with low to minimal biosecurity. Birds or bird products enter live bird markets or other local distribution systems. Examples include caged layer farms with birds in open sheds, farms with poultry spending time outside the shed (free range), and farms producing both chickens and waterfowl.

Then, there are commercial poultry production systems with moderate to high biosecurity. Birds or bird products are usually marketed commercially. Farms with birds kept indoors continuously- strictly preventing contact with other poultry or wildlife- would fall in this category.

At the most sophisticated level are industrial systems with high level biosecurity and birds or bird products that are marketed commercially. Many farms that are part of an integrated broiler production enterprise have clearly defined and implemented standard operating procedures for biosecurity.

Ensure Biosecurity through
Bioexclusion

- **Keep poultry indoors**
 - Separate from the outside world
 - Remove or disinfect all sources of infection
- **Prevent unknown birds from entering flock**
- **Control human, vehicular, and equipment traffic onto the farm**
- **Use “all in – all out” production**
- **Separate new poultry for 2 weeks**
- **Clean and disinfect when “all out”**

AI can remain viable in tissue, feces and water for a long period of time (days to weeks)

In order to prevent a disease from entering a farm, a barrier must be created and maintained between the farm and the outside world. Since we know that avian influenza can be transmitted through feces, respiratory secretions and objects, all possible sources of infection must be either removed, disinfected or isolated.

Of particular interest at the large poultry farm level, is the exclusion of wild fowl from domestic stock. This would include separation of drinking reservoirs, feed stations, and so on. This may also include clearing any unwanted brush away from cages and keeping poultry indoors. Decontamination of all potentially infected objects (hands, shoes, etc) with chlorinated compounds or ultraviolet light should be considered. In any case, the elimination of possible mixing of wild and domestic birds is an excellent way to prevent infection or spread of avian influenza. Limiting the number of people that have contact with the poultry can also limit potential exposure to the outside world.

In addition, control of movement of replacement animals may help reduce the risk of AI. This may be accomplished by so-called “all-in, all-out” methods of livestock rearing, in which all the animals coming in to a farm do so at the same time. Once they are ready to be sold or move to a larger facility, they all do this at the same time as well. However, if this is not possible and new poultry are brought in to join an existing flock, it is advisable to separate any new poultry for 2 weeks before adding them to the group.

For major poultry farms, a biosecurity plan must be drawn up and adhered to by all workers coming in and going off the premises. This may include limiting the number of people allowed on or off a farm. Compliance is the key for keeping biosecurity useful!

Biocontainment on Infected Farms

- Depopulation of infected and exposed birds
- Movement control
 - On and off farm
- Bird markets and swap meets closed and disinfected
- Testing of potentially infected birds

Once an area is known to be infected, it becomes necessary to try to prevent spread to non-infected areas. First and foremost in prevention of spread is the immediate depopulation of an infected farm (more on proper disposition of carcasses later). Movement into and out of infected premises (by people, birds, or objects) should be controlled by a veterinarian. Bird markets around an infected area or markets or swap meets that receive birds from an infected area should be closed, depopulated, cleaned, and disinfected. Testing of potentially exposed birds should commence immediately.

Destruction or Disposal of Birds in Affected Area

- Humane killing of birds
 - Carbon dioxide
 - Dislocate neck
 - Others
- Disposal per EPA guidelines
 - Burn
 - Bury
 - Do NOT dump in local water sources
- Cleaning and disinfection
- Allow 21 days before getting more poultry



3/1/2006 Reuters, Karachi

Once a farm or other area has been confirmed as infected, immediate measures must be taken to depopulate it.

If LPAI is confirmed, the state will take the lead in the investigation and control measures. If HPAI is confirmed, the USDA will take the lead, as HPAI is classified as a foreign animal disease.

The first step is to humanely euthanize all infected and potentially infected animals on site. Although there are many acceptable methods for euthanasia in the US, one of the most commonly used methods is asphyxiation by carbon dioxide. Alternately, swift cervical dislocation can be used. Accurate records of destroyed animals must be kept in order to obtain compensation.

Once animals have been euthanized, appropriate methods of disposal should be conducted per the Environmental Protection Agency Guidelines. These methods include burning, burying (on site), or composting. It is important to remember not to expose the local water source to potentially infected carcasses when burial is used as a method of disposal.

Cleaning and disinfection should then take place, with the use of either chlorinated cleaning solutions, alkalis, detergents, or ultraviolet light (of particular use in outdoor areas). Cleaning will not be effective if organic material such as blood, feces, etc. are not cleared away first.

Allow at least 21 days before restocking, after an official inspection.

When to Investigate

- Clinical signs of HPAI
- Local or regional surveillance detects possibility of infection
- Lab tests confirm infection
 - Virus isolation necessary to distinguish from other fatal poultry disease (fowl cholera, Newcastle disease, etc.)
- Institute proper chain of reporting, disposal, and testing for infected area and surroundings

Now the question becomes, when should an investigation be launched? Any clinical signs among the poultry that could be a result of HPAI should be an indication to investigate. As discussed previously, when local or regional surveillance detects a potentially infected farm an investigation will be initiated. Next, lab tests would be used to confirm or deny the existence of HPAI on the farm. If it is suspected that HPAI has arisen, appropriate reporting and control measures should be implemented immediately!

Vaccination for Poultry

- Inactivated whole AI virus
 - Effective against H5 subtype
 - Good resistance to infection
 - Reduced amount of virus in environment
 - May have subclinical infection
 - Can still shed virus
 - Administered by injection

A vaccine is available for poultry against avian influenza. The vaccine itself is an inactivated whole AI virus which contains a determinant that is effective against the current H5 subtype. It potentially confers good resistance to infection, and also reduces viral shedding. This can limit the spread of infection and decrease the contamination of the environment from infected animals. The vaccine can also decrease the clinical disease among infected birds. This actually poses a problem, because these infected animals may continue to shed virus, without the clinical warning signs of unvaccinated birds. Thus, no measures would be taken to limit the spread of infection.

One disadvantage is that the vaccine must be administered by injection. Currently there is a great need to develop a vaccine that could be administered in feed or water, like other poultry vaccines.

Vaccination and Antivirals for Poultry

- Vaccination may limit exportation
- New recombinant fowlpox vaccine?
- Antivirals for only for humans, not birds
 - Potential for resistance

It will be up to local and state officials, as well as poultry farmers, which animals to vaccinate or whether to try the vaccine at all. Vaccinating chickens against HPAI poses a problem for exportation. Many countries will not import poultry that have been vaccinated against AI, for fear of accidentally importing birds that are harboring the avian influenza virus, unless the exporting country can document that the animals have not been infected.

There is current research into using a fowlpox virus-vectored vaccine (and other recombinant vaccines) that would be effective in preventing AI, however, it is unclear at this time how effective it would be in older animals or non-gallinaceous animals. One advantage of this type of vaccine would be that the difference between infection and vaccination would be easy to differentiate, due to the limited antigens that would be expressed in vaccinated birds vs. naturally infected birds.

Unfortunately, there is not much research today on effective antivirals for birds. If infected, the easiest way to “treat” birds is to euthanize.

Occupational Guidelines

We will conclude this talk with a brief review of the occupational guidelines for those who may come into contact with HPAI.

Occupational Guidelines

- For persons in contact with healthy birds in HPAI-free zones
 - Increased vigilance and hazard communication
 - Standard Personal Protective Equipment (PPE)
 - Risk assessment for processing of species that may exhibit asymptomatic disease (e.g. ducks)

Next, we will talk about some of the occupational guidelines for responders and poultry workers who may come into contact with HPAI in the course of their work. The first thing that we should stress is that any persons in contact with clinically healthy poultry or materials in HPAI-free zones would not be under specific USDA control and prevention efforts. Therefore, it is not necessary to use the type of personal protective equipment (PPE) that would normally be used if exposure to HPAI was a risk in outbreak investigations. If HPAI has been identified as active in the US, increased hazard communication should be in place and routine surveillance and testing of flocks prior to slaughter would be instituted as well. Risk assessment measures should also be in place for people who work those species (e.g. ducks) that can potentially carry HPAI with no symptoms.

Occupational Guidelines

- For persons in direct contact with known or suspected HPAI materials
 - Training, basic infection control, PPE to include respirators and antiviral prophylaxis
 - Surveillance and monitoring of workers
 - Evaluation of ill persons

For people who do come into contact with known or suspected HPAI positive poultry, feces, fluids, etc., there are measures that should be taken to prevent the spread of the disease. These include basic infection control training, PPE (which would include respiratory protection, latex gloves, etc.), and courses of antiviral drugs (e.g. oseltamivir). Thorough surveillance and monitoring of workers exposed to the virus should also be implemented, as discussed earlier in this training. If at any point, any worker becomes ill with respiratory symptoms, evaluation and possibly isolation should begin immediately.

Occupational Guidelines

- For exposure to a known HPAI source

- Disposable particulate respirators (N-95 or greater); or powered air purifying respirator
- Current season influenza vaccine
Reduces possibility of dual infection with human and avian influenza, which could lead to reassortment

For people who have more direct and substantial exposure to HPAI or materials contaminated with HPAI, even stricter guidelines should be in place.

Disposable particulate respirators, such as N-95 or greater, are the minimum level of respiratory protection that should be worn. Workers must be fit-tested to the respirator model that they will wear and also know how to check the face-piece to face seal. In some instances, such as in farms using oil as dust suppressants, R or P series respirators should be used instead of N series. It is important to note that these types of respirators do not provide protection to some of the chemicals used in sterilization procedures in decontamination efforts. Workers who cannot wear a disposable particulate respirator because of facial hair or other fit limitations should wear a loose-fitting (i.e., helmeted or hooded) powered air purifying respirator equipped with high-efficiency filters.

All workers should also have received the current season influenza vaccine to prevent dual infection with avian and human varieties of the disease.

Occupational Guidelines

- For persons in contact with live or dead poultry or materials later identified as HPAI
 - Medical evaluation
 - Post-exposure prophylaxis
 - Surveillance for respiratory-related symptoms
 - Fever
 - Respiratory symptoms
 - Conjunctivitis

For people who come into direct contact with poultry or materials later identified as contaminated with HPAI, it is important to evaluate them for clinical signs and symptoms of HPAI. This may include post-exposure-prophylaxis (PEP) with antiviral drugs. Medical surveillance should also be in place for at least 10 days post-exposure. Notifiable conditions would include illness such as conjunctivitis, fever, or respiratory symptoms.

Take Home Message

- Isolate domestic birds from wild water birds
- Multiple agencies work with USDA, establish ties to ensure swift, effective response



The best method of preventing AI in commercial and non-commercial poultry flocks is the isolation of domestic birds from wild birds, especially water fowl. Whether on large industrial farms or backyard farms, avoiding contact with carriers of the virus is essential. We have discussed measures that can be taken in order to accomplish this.

Preventing avian influenza on poultry farms is a multi-disciplinary task. Farmers, agricultural responders, veterinarians, and public health responders need to establish ties on local, state, and national levels. Effective infrastructure and planning will help ensure a swift and coordinated response should an outbreak occur.

Helpful web sites

- Centers for Disease Control: www.cdc.gov
- World Health Organization: www.who.int/en/
- World Organization for Animal Health: www.oie.int
- UN Food and Agriculture Organization: www.fao.org
- US poultry and Egg Industry Association
<http://www.poultryegg.org/>
- USDA Avian Influenza website
http://www.usda.gov/wps/portal/usdahome?navid=AVIAN_INFLUENZA&navtype=SU

Investigation of Poultry on a Farm

Exercises

Exercise 4

Investigation of Poultry on a Farm

Objectives:

- Assess clinical symptoms among poultry for index of suspicion of AI infection
- Prioritize response actions with partner agencies
- Evaluate biosecurity measures during an outbreak

Instructions:

For this exercise, you will work with your group to complete a case study investigation. Each segment of case study information will be followed by a series of questions. Your facilitator or one person in your group should read the information aloud to group members. Then, work as a group to generate one answer for each question asked.

Time allotted: 30 minutes

The Situation

You are a public health officer in a rural part of the country. This is an area where there are many moderate and large poultry operations. You get a courtesy call from the local office of the State Agriculture Department saying that a particular layer operation of 30,000 chickens has recently experienced a large number of die-offs over a 6-day period of time- over 20% of the poultry have been found dead. This farm has an excellent record for vaccinating its flock for the recommended diseases. The office is concerned that this illness could be something unusual and potentially hazardous not only to other poultry farms, but to poultry workers and possibly the public as well.

Question 1 – What types of diseases, for which poultry are not typically vaccinated, cause large die-offs in a short period of time?

Suggested answer – *Avian influenza and Exotic Newcastle Disease of chickens and turkeys with various levels of pathogenicity are frequently indistinguishable on clinical and post-mortem examination from: mycoplasmosis; fowl cholera; Escherichia coli cellulitis of the head; acute pasteurellosis; infectious laryngotracheitis; infectious coryza; avian chlamydiosis; acute poisoning; or misadventure causing high mortality (for example smothering, heat stress, or dehydration). HPAI should be suspected whenever sudden bird deaths occur with severe depression, loss of appetite, nervous signs, watery diarrhea, severe respiratory signs and/or a drastic drop in egg production, with production of abnormal eggs. The likelihood of AI is increased by the presence of facial subcutaneous edema, swollen and cyanotic*

combs and wattles, and petechial hemorrhages on the internal membrane surfaces.

Additional Background

The symptoms were first reported by the farmer to his veterinarian; the veterinarian contacted the State Agriculture Department. The symptoms include a large decline in egg production, swollen wattles and combs, and strange hemorrhages under the skin. The farmer also reports that some poultry were found dead with no apparent symptoms. The farmer has said that this illness has seemed to come on very swiftly with no previous illness in the flock within the last month.

Question 2 – Would you be worried about HPAI at this point?

Suggested answer – *Yes. Given the symptoms and the rapid onset of disease, there is definitely a potential for HPAI to be the etiologic agent involved.*

Current Conditions

Of the animals at this particular operation, approximately 95% of the visibly ill layers have died. The farmer is worried about continued die-offs and asks for help trying to figure out what to do. He is worried about the rest of his flock, as well as the potential income loss from any type of outbreak situation.

Question 3 – How would you begin your investigation, and how would your investigation overlap with that done by State Agriculture?

Suggested answer – *You would probably start by talking to State Ag to coordinate interviewing the farmer. State Ag and Public Health are likely to have many of the same questions. The interview could be done jointly, or State Ag could conduct the interview and pass the information on to Public Health. If further information is need for public health purposes, you could then arrange an additional short interview with the farmer. Some key questions to ask would include:*

- *Are any of his workers or family members sick with flu-like symptoms?*
- *In the 72 hours prior to the onset of clinical disease, who has had contact with the poultry, poultry carcasses or other poultry products that may be infected?*

- *How extensive is that contact for each person?*
- *What is the contact information (address and phone number) for every person who has had contact with the poultry (for continued follow-up if necessary)?*
- *What types of routine procedures or PPE were used by workers when working with the poultry?*
- *Who has been to the farm to provide ancillary services during this time (such as the veterinarian)? What other farms have they visited since that time and have any of those farms had any clinical signs?*

Other questions to ask:

- *Where does he get his birds?*
- *When was his last shipment of new layers?*
- *How and where are poultry and eggs sold, and when did the last transaction occur?*
- *Does he practice all-in, all-out management?*
- *Do his birds have access to the outside of the facility (including any potential shared water sources, holes in building structure). Do his poultry have any access to wild birds?*
- *How are dead poultry handled?*
- *Have any other birds or animals on the farm been sick or died unexpectedly in the 72 hours prior to onset of clinical disease in the poultry?*
- *Does he operate any other poultry facilities?*
- *Where does he get his feed?*
- *Does he share equipment with any other farmers?*

You should also inquire from public health, agriculture, and wildlife as to any active HPAI surveillance in the area and any positive findings.

Both Public Health and Agriculture will need to ask these types questions to assess types of exposures and the biosecurity practices in place on the farm. The first set of questions is more specific to Public Health. Public Health would also have the responsibility of educating the farmer about symptoms of the disease and appropriate personal protective equipment.

Question 4 – If you were to visit the farm to participate in the investigation, what biosecurity measures should you take to ensure that the virus is not spread off the farm (by you)?

Suggested answer – *Some measures include spraying car tires with bleach, washing and changing boots, and washing hands. Often health professionals are unaware that these measures need to be taken.*

Discussion Question – In your jurisdiction, is there a protocol or understanding in place between the Departments of Public Health and Agriculture for investigations concerning avian influenza on a poultry farm?

Suggested answer – *Because both Public Health and Agriculture will want much of the same information, coordination between agencies is essential to prevent individuals associated with the farm from answering the same questions twice. Information collection could be done by a team with representatives from both agencies, or one agency could gather the information and share it with the other.*

Have the group identify appropriate mechanisms for sharing information, communicating results, discussing PPE, and assuring the health and safety of workers and response personnel. Encourage participants who can identify key players in the poultry industry, public, veterinary professional community, and USG regulatory community to share their protocol.

Additional information

You and a representative from State Agriculture talk to the farmer; he tells you that he recently (in the last 2 weeks) he obtained some new stock from a company that he has been using for over 10 years. His operation is not all-in-all-out. The building where the poultry live is well constructed with no access possible to the outside environment. The flock is fed and watered with no possible contamination from wild birds outside the premises. No one in his family or crew appears to be ill at this time. You also inquire into the human, poultry, and wild bird HPAI surveillance and there has been no reported activity in your area. There have, however, been reports of a confirmed case of H5N1 in a duck in another part of the country.

Question 5 – What does this information tell you?

Suggested answer – *This information is helpful because it does suggest that HPAI is active at least in some part of the country. Since HPAI can be carried by wild birds, you cannot rule it out as a potential source of this outbreak, even if there are no other reports in the country.*

Question 6 – At this point, would you involve national organizations in your investigation?

Suggested answer – *Yes. It is clear that this is an agent that exhibits very high morbidity and mortality among poultry. There is a very short list of diseases that do this in vaccinated flocks, most of which are reportable. Since there has been some HPAI activity at least in some part of the country, it would be best*

to involve national organizations in your search for the cause, due to potential economic consequences, the need for coordinated risk communication efforts, and also due to expanded networking and laboratory facilities. Although only confirmed H5 is reportable, the state veterinarian's office would probably have contacted USDA already with the details on this situation. Contacting CDC/FDA/USDA-APHIS would be advisable.

Testing

The State Department of Agriculture is assisted by the USDA to institute quarantine and movement control procedures on the farm in question. They immediately begin testing of the flock for foreign animal diseases of concern.

Question 7 – You are to be involved in carrying out testing and quarantine, if necessary. What are your suggestions to the farmer and his family as to their risk of infection? What other individuals should you be concerned about testing and/or counseling?

***Suggested answer** – Since the cause of the disease is not yet known and there is the possibility of HPAI, you could suggest to the farmer that he and his family institute standard PPE measures when working with the poultry, including face masks/respirators, latex gloves, and basic infection control (washing hands, etc) especially after coming into contact with any live or dead chickens, or any potentially contaminated materials. You could also suggest that workers and family members should monitor themselves for signs and symptoms of AI for 10 days following their last exposure to any potentially infected poultry. If they become sick with a fever, respiratory symptoms, or other clinical signs and symptoms of AI during this time, or if they have a fever without respiratory symptoms, they should notify you or another public health official immediately. You should interview all workers and family members to determine their exposure to the infected poultry and the need, if any, to institute antiviral prophylaxis.*

It is important to note that public health workers are also responsible for safeguarding the health of those who respond to the outbreak. This includes farm employees and State Ag employees, as well as veterinarians, public health officials, and anyone else who has entered the premises to work on the investigation. It is important to build a collaborative relationship with these individuals – State Ag would be lead in the investigation, and you can assist them by ensuring that their workers are appropriately followed up.

Question 8 – As a public health responder, what other activities should you undertake immediately, before conclusive test results come back from the laboratory?

Suggested answer – *Many responses need to occur at the same time. The on-site response has primarily been discussed here. Additional response activities would involve getting prepared to take immediate action should HPAI be confirmed. This includes getting lists of people on the farm and their contacts and crafting communication messages aimed at the community, industry, and other groups that may be affected.*

Conclusion

The next day, the results come back. The illness in question is determined to be Exotic Newcastle Disease. Several other farms in the area have become infected also at this point. The affected flocks are being depopulated. The USDA determines that the index case occurred in an animal shipped to the farmer from his supply company. Since this disease is not a threat to humans, you are relieved for the farmer and his family. However, you wonder about the one positive case of HPAI that had been found in another part of the country.

Question 9 – If the disease in question had turned out to be HPAI, how do you think that the investigation would have continued?

Suggested answer – *Quarantine/isolation of the affected farm would have remained in place, and the entire flock would have been depopulated and disposed of using approved techniques. Testing for HPAI would have continued through virus isolation or PCR. The quarantine and testing area would have expanded to include the surrounding area. Movement restrictions for poultry and poultry products would have been placed in a zone around this area with increased surveillance for HPAI. Wild birds in the area may have been tested as well. Continued monitoring and prophylaxis of farm workers and family would have been instituted. Any contacts that developed respiratory symptoms would have been immediately treated as suspected cases, isolated and treated appropriately. They would be given supportive care and anti-virals such as Tamiflu as well as having contacts followed. Specific procedures for contacts may depend on the state – some states may ask asymptomatic contacts to limit their exposure to others ('self-quarantine'). Surveillance would also expand into the community, to monitor for potential spread of the virus.*

Module 5

Case Management of Suspect Human Avian Influenza H5N1 Infection

Exercises

Exercise 5

Case Management of Suspect Human Avian Influenza H5N1 Infection - Case Management and Public Health Action

Objectives:

- Identify clinical features of suspect avian influenza H5N1 infections
- Assess exposure to avian influenza H5N1
- Provide recommendations to healthcare providers in the management of suspect avian influenza H5N1 patients
- Minimize the risk of spread or further human illness associated avian influenza H5N1

Instructions:

In this exercise, you will work with your group to decide on recommendations for healthcare providers on case management and also the public health actions you will need to take when alerted to a potential avian influenza H5N1 case.

Each segment will be followed by a series of questions. Your facilitator or one person in your group should read the information aloud to group members. Then, work as a group to generate one answer for each question asked.

Time allotted: 2 hours

Background

It's Friday afternoon, September 1, 2006. You are at work at the local health department when you get a phone call from Dr. Patel at the University Student Health Clinic. Dr. Patel has been treating a 21 year old college student named Ben. On August 30, Ben had a high fever and shortly thereafter, he began to have a sore throat. Ben came into the clinic on August 31. He had a fever of 30 C/102.2 F. No other respiratory symptoms were observed.

In speaking with Ben about his recent activities, Dr. Patel learned Ben has spent the past two months in Indonesia working on a research project. He arrived back in the US on August 28.

Dr. Patel thought Ben may have acquired a respiratory pathogen while traveling abroad so he prescribed him ciprofloxacin and sent him home. Ben has returned to the clinic today with a cough. Dr. Patel was aware of the CDC case definition and its epidemiologic criteria through educational outreach from the State and Local health departments.

Question 1 – What are common signs and symptoms of seasonal influenza and avian influenza H5N1?

Suggested Answer –

Seasonal influenza: fever, headache, cough, variable respiratory symptoms from sore throat to difficulty breathing, and gastrointestinal symptoms in children and elderly. Upper respiratory infection.

Avian influenza H5N1: fever, headache, cough, difficulty breathing, crackles, increased respiratory rate, diarrhea, vomiting, abdominal pain, laboratory findings of lymphopenia. Lower respiratory infection.

Note that these symptoms are non-specific, and not enough to suspect avian influenza in the absence of meeting epidemiologic criteria.

Additional Background Information

Based on his physical examination, Dr. Patel has decided to admit Ben overnight to University Hospital to receive intravenous (IV) fluids.

Dr. Patel is aware of animal and human cases of avian influenza H5N1 in Indonesia. However, since Ben didn't have any respiratory symptoms when he first presented, Dr. Patel didn't think it was influenza. Now that Ben has a sore throat, Dr. Patel decided to do a rapid test for influenza A and the result was positive.

Question 2 – Does a positive result for a rapid influenza A test indicate someone is positive for avian influenza H5N1 infection?

Suggested Answer – *No, a positive rapid influenza A test result cannot differentiate seasonal influenza A from H5N1. In addition, rapid tests have low specificity and sensitivity so Ben's result may be a false-positive. Specificity is the ability of a test to give a negative result for those who are truly negative (therefore, a test with low specificity will not necessarily show the 'truth' for a negative test result). Sensitivity is the ability of a test to give a positive result for someone who is truly positive. However, the rapid test has a high predictive value positive – meaning that a high proportion of those who test positive are infected. Therefore this test can help in making treatment decisions, but it does not serve to confirm H5N1 infection. Good old fashioned clinical symptoms and epidemiologic evidence should be strongly weighed when assessing initial suspicion for avian influenza.*

Question 3 – Based on the information at hand, how would you classify Ben according to your case definitions (see Appendix A)? Why?

Suggested Answer — Ben would be a “report under investigation”. Although Ben meets the clinical definition for a suspect case, he does not meet the criteria for exposure within 10 days of onset. In order to classify Ben as a suspect case, we need to assess his potential exposures within the 10 days before onset to sick or dead birds, or close contact to any ill persons.

Question 4 – Dr. Patel will be hospitalizing Ben. Would you recommend Ben be placed in isolation? Why or why not?

Suggested Answer – Ben has recently been to a country with AI, and the doctor suspects that H5N1 is a possible diagnosis. Since he would be the first case of H5N1 in animals or humans in the US, it would be prudent to place Ben in isolation. In addition to standard precautions, airborne/droplet (negative pressure room, N95 mask or more protective) precautions should be instituted as well as eye protection, and contact precautions (gloves and gown worn), as appropriate for the type of contact anticipated. Dedicated equipment should be used in caring for Ben. Finally, the examination room Dr. Patel has used to examine Ben should be disinfected properly before anyone else is examined in the room. (Note: proper disinfection involves first cleaning any dirt or debris from all surfaces using detergent and mechanical force, such as scrubbing. After cleaning, disinfect surfaces with household bleach solution or ammonia solution).

Recommendations

Dr. Patel asks you “Could this be avian influenza H5N1? What should I do?”

Question 5 – What recommendations would you offer about treatment for avian influenza H5N1?

Suggested answer – The case definitions provided in the CDC guidance are for public health surveillance purposes, not for diagnosing patients. Therefore you must use your best judgment when deciding to recommend treatment based on the limited information you have. Time is important in treating patients who may have avian influenza H5N1 as you like to begin treatment as soon as possible, generally within 2 days of symptom onset. Since Ben has symptoms that could indicate avian influenza H5N1 infection and was in a country with avian influenza H5N1 activity, it would be best to advise he begin treatment with a neuraminidase inhibitor, preferably oseltamivir. He should receive 75 mg for 5 days. Another option for treatment is zanamivir. Zanamivir should not be used in the very young or among those with reactive airway disease. The antivirals Amantadine and Rimantadine should NOT be given, as there is evidence that a mutation that confers resistance to these drugs is increasing among H5 viruses.

Question 6 – What recommendations would you offer about testing for avian influenza H5N1?

Suggested answer – *Although Ben has received ciprofloxacin, testing for avian influenza H5N1 is still possible as viruses are not affected by antibiotics. If possible, collection of respiratory aspirates or other lower respiratory tract specimens (bronchoalveolar lavage, tracheal aspirate, pleural fluid tap or sputum), which are easiest to collect if the patient is intubated, or oropharyngeal swabs are preferred as these have the highest yield. Other types of specimens should also be taken in this case (i.e. nasopharyngeal swabs, acute and convalescent serum, stool if diarrhea is present). Specimens should be collected daily until the virus has been identified, to increase probability of identifying avian influenza H5N1.*

Question 7 – Before you hang up with Dr. Patel, what information would you like to collect from him? You plan to interview Ben but what additional information would you like for Dr. Patel to get from Ben now?

Suggested Answer –

From Dr. Patel

- *Ben's contact and demographic information: Be sure to get Ben's last name and also his date of birth, and language spoken. Contact information is vital for follow up so be sure to get Ben's address, home phone number, mobile number, email address, etc.*
- *Symptom profile: Review symptoms with Dr. Patel to be sure you captured all information and be sure to confirm date of onset.*
- *Travel: Review Ben's travel history with Dr. Patel to ensure you have collected all information available.*
- *Attending Physician: Be sure to have Dr. Patel or his staff contact you as soon as Ben has been admitted and provides you with the name and phone number of his attending physician. You will need this for follow up.*
- *Dr. Patel's contact information: Be sure to collect Dr. Patel's phone number so you can contact him if you have any further questions or if you are unable to follow up with Ben.*

From Ben

- *Exposure: You would like to know if Ben has had any contact within 10 days of symptom onset with any sick or dead birds, or any ill individuals.*
- *Ben's contacts: Anyone who has had recent close contact with Ben might need to be evaluated – and the longer you wait to gather this information, the poorer his recall will be.*
- *Other ill: Are any of the other project members ill?*

Information from Dr. Patel

Below is information Dr. Patel has at the moment on Ben. Please complete the attached case history form with as much information as possible. Please be sure to update the case history form as you learn more information.

Name: Benjamin Diaz DOB: 04/15/1985 Race: Hispanic, non-white
Address: 453 Berkshire Lane #3D, Collegetown, NC 29896
Home phone: none
Cell phone: 919.555.8695
Occupation: student

Contact Name: Dr. Sunil Patel
Contact Address: University Student Health Center, 300 Patterson Road, Collegetown, NC 29894
Work phone: 919.555.6589
Pager: 919.555.2874

Question 8 – Once you hang up with Dr. Patel, what should you do?

Suggested Answer – Arrange to speak with Ben to determine what his exposures may have been (human or animal). You will need to follow the appropriate investigative procedures – assign Ben a unique identifier that can be used on case interview forms and laboratory samples. You may use the WHO standard forms as a reference (Appendix B). Standardized data collection will be vital for having useful data during a potential avian influenza event.

- *Case form: Complete as much of the case information form for avian influenza H5N1 as possible with the information you received from Dr. Patel.*
- *Notification: Notify all relevant staff members about Ben. This will vary across jurisdictions but may include your direct supervisor, environmental health coordinator, public information officer, state health department staff, and the state veterinary office.*
- *Communication: Begin to put together literature on avian influenza H5N1 for healthcare providers to give to patients. Make sure the information is consistent with current guidelines. Also begin to put together information for the worried well especially detailing information about infection control in the home.*

Follow Up from Dr. Patel's Office

Isabella from Dr. Patel's office calls you an hour later with some of the information you requested about Ben. He has now been placed in isolation under the care of Dr. Dorian. Dr. Dorian's pager number is 210.555.8926.

Ben's project required him to go to rural areas of East Java Province. Ben had contact with more than 50 residents of East Java and notes that many households had chickens that roamed freely in and out of the house. He did not recall seeing any dead chickens, but notes that a couple of the individuals he had contact with appeared to have colds. You know that H5N1 influenza has been reported in this part of the country. Most cases of H5N1 in humans have been due to transmission from infected poultry or poultry products to people, but you know a real worry with this virus is that it could change just enough to pass easily from person to person, sparking a deadly epidemic.

So far, you cannot determine whether Ben might have been exposed to infected poultry or infected people.

Ben hasn't spoken to any of his project members except for his advisor. His advisor just returned from Indonesia two days ago and was fine when Ben spoke with her.

Question 9 – Has this new information changed Ben's case classification? Why or why not?

Suggested Answer – *Ben would be a suspect case of avian influenza H5N1 if he meets the following criteria:*

- Documented temperature ≥ 38 C (≥ 100.4 F) and one of the following: cough, sore throat, and/or respiratory distress AND
- One of the following exposures within 10 days of onset
 - a. Direct contact with sick or dead domestic poultry
 - b. Direct contact with surfaces contaminated with poultry feces
 - c. Consumption of raw or partially cooked poultry or poultry products
 - d. Close contact (within 3 feet) of an ill patient with confirmed or suspected H5N1 infection
 - e. Works with live H5N1 influenza virus in a laboratory

▪ Laboratory test for H5N1 is pending, inadequate or unavailable
Ben meets the first and last criteria, and whether he has had close contact with a suspected person with H5N1 infection should be investigated.

Question 10 – With this information from Isabella, what actions would you take?

Suggested Answer –

- *Follow up with Dr. Dorian:*
 - f. *Assure that specimens have been collected and testing is being done Repeated sampling can also be done and is advisable*
 - g. *Confirm that antiviral therapy has begun*
 - h. *Check on the possibility of interviewing Ben today*
 - i. *Find out about new symptoms or tests that may have been completed*
- *Notify the public health laboratory about the pending specimen*
- *Notify relevant parties of new information and updated case status*
- *Begin monitoring for symptoms of infection in healthcare personnel who have worked with Ben*
- *Contact CDC – the International Division can report Ben’s condition and observations back to the WHO contact in the Southeast Asian Regional Office (SEARO). SEARO can then investigate other possible cases in Java, and perhaps also provide more information about Ben’s contacts.*

Dr. Dorian

Dr. Dorian returns your page around 3:00pm. He has spoken with Dr. Patel who has brought him up to speed on Ben’s situation. Ben has been admitted into the hospital where he has been placed in isolation. Ben was placed on IV fluids. Nurse Todd is with Ben collecting specimens from Ben’s oropharyngeal airway. After specimens have been collected, Ben will be given a dose of oseltamivir.

Ben’s fever is 39.2 C/102.6 F and he is now complaining of a headache. Other than the sore throat there is no other respiratory symptom. Blood work and a chest X-ray were ordered but Dr. Dorian does not have the results.

You ask Dr. Dorian if it would be possible for you to interview Ben. Dr. Dorian agrees to let you interview Ben but asks you come soon.

Question 11 – What personal protection steps should you take when speaking with Ben?

Suggested answer – *You should follow infection control measures in hospital settings for suspect avian influenza H5N1 infections. Because you are not providing healthcare, you do not need to don full PPE. However, you should remain at least 3 feet away from Ben, and wear an, N95 or superior mask, and wash your hands upon leaving the room.*

Question 12 – With your group, develop 5 to 10 key questions that should appear on a questionnaire that you would administer to Ben.

Suggested answer – *The group may use the WHO Case Investigation form as a resource for developing questions in this situation. (See Appendix B).*

Laboratory Findings

When you arrive at University Hospital, you head directly to the nurse's desk on the floor where Ben is staying. She pages Dr. Dorian who appears shortly thereafter. He has a few minutes to talk to you about Ben.

Specimens have been collected and will be forwarded to the state public health laboratory for testing. Ben was given oseltamivir.

The following are results from Ben's blood work up and chest x-ray:

Initial laboratory studies	Normal Values
- Leukocyte count of 2800/mm ³	4,300 - 10,800/mm ³
- Lymphocyte count of 640/mm ³	1500 - 4000/mm ³
- Hemoglobin of 12.5 g/dl	12 - 18 g/dl
- Platelet count of 125,000/mm ³	150,000 - 400,000/mm ³
Blood glucose 93.6 mg/dL	39.6 - 126.0 mg/dL
Liver function tests are normal	
Chest x-ray is clear	

Question 13 – Based on these results, how would you classify his leukocyte, lymphocyte, platelet counts as well as his hemoglobin level? Are these signs compatible with avian influenza H5N1?

Suggested Answer – *Ben's drop in leukocyte, lymphocyte, and platelet counts are all consistent with laboratory findings from human avian influenza H5N1 infections. His hemoglobin level is normal although close to the minimum bound.*

Ben's Interview

You learn Ben arrived in Indonesia on June 16 and went directly to East Java Province where he stayed in a rural village going door-to-door to interview residents. Project members were assigned to different villages throughout Indonesia but his advisor Cassie was based in East Java Province. She occasionally visited the village to collect Ben's interviews and came to the village on August 25 to collect his last interviews. Otherwise Ben did not see any of the other project members.

Ben had his own room in a small hotel in the village and made a few friends during his stay. As he told Isabella, he could not recall seeing dead chickens but did have contact with one or two people who were ill. He returned to the US on Stargaze Airlines FL#543. It was a direct flight, arriving on August 26. His parents picked him up at the airport. He stayed the night with his parents and traveled back to the University the next day.

Ben has one roommate but he is a medical student on rotation in another state. He has not seen the roommate since he left for Indonesia.

Below are the details of Ben's close contacts and their contact information:

Name: Joe Diaz	Relationship: Father	Contact: 210.555.9686
Name: Jaclyn Diaz	Relationship: Mother	Contact: 210.555.9686
Name: Cassie Livingston	Relationship: Advisor	Contact: cannot recall

*Please update your case history forms with this information

Question 14 – With this information, what steps would you take next?

Suggested Answer –

- *Contact CDC's Division of Global Migration and Quarantine for help tracking the health status on persons of flight 543.*
- *Try to find Cassie's contact information on the school's website, telephone book, etc.*
- *Follow up with Ben's contacts to assess their status and complete contact case forms*
- *Update all relevant parties about Ben's information.*

The Weekend

You spend your weekend trying to get a hold of Ben's parents and his advisor Cassie. You manage to track Ben's parents down on Saturday afternoon, September 2, at the hospital. They have just arrived to visit Ben.

They tell you they do not have any symptoms. You complete a contact form for each one.

You receive a phone call from your contact at the CDC. World Health Organization investigators have been working with Indonesian authorities in East Java Province, and have determined that H5N1 is present in the area where Ben was working. Human to human transmission among two families there cannot be ruled out at this point.

Question 15 – Do you think Ben became infected through human-to-human transmission? What other information would you want to know?

Suggested Answer – *If Ben does indeed have avian influenza, it is possible that he became infected through his exposure to the ill persons he had contact with in Indonesia. You would need to know about ALL contacts he had with poultry, sick animals, or potentially contaminated materials to rule out all these possibilities. You will need to know the exact dates of his contacts with people and other possible exposures. You need to know whether the ill persons he had contact with have suspected or confirmed avian influenza, the extent of his contact with these persons (i.e., close contact within 3 feet), and if this contact occurred more than 10 days previously (contact more than 10 days ago is not likely to be the cause of his current illness). It may never be possible to determine all of this information. The focus for the moment must be on responding to the situation in the US to ensure no secondary transmission occurs.*

Question 16 – What recommendations do you offer Ben's parents? As a group, create a short script for how you would explain your recommendations to his parents.

Suggested Answer – *Ben's parents should receive the current influenza vaccine, and you might ask them if they would voluntarily quarantine themselves at home. Antiviral chemoprophylaxis should not be recommended until laboratory results confirm Ben's diagnosis. They should also be instructed to self monitor for symptoms for up to 10 days after their last unprotected exposure to Ben. Symptoms may include fever, respiratory symptoms, diarrhea and/or conjunctivitis. They should seek medical care immediately if any of these symptoms present and should alert their healthcare provider to their current situation. They should also notify you immediately. In*

addition, you should provide information for infection control measures in the home. All of this should be provided to them on paper so they may have it readily available for reference. As a matter of protocol, you will want to provide them with your business card so they can contact you if they have any questions or concerns. These recommendations may seem complicated or difficult to individuals who are worried about their loved ones and their own health – encourage the script to be clear, concise, and simple.

Question 17 – Would you recommend Ben’s parents receive the avian influenza H5N1 vaccine?

Suggested answer – *No, there is no vaccine currently available for commercial use.*

The Weekend (continued)

You are in contact with Dr. Dorian over the weekend and learn Ben’s condition is worsening. He is beginning to show signs of respiratory distress. He is beginning to require supplemental oxygen to maintain normal oxygen levels. Furthermore, his chest x-ray reveals bilateral infiltrates, his blood glucose has risen to 12.6 millimoles per liter, and his liver enzymes (AST and ALT) are elevated.

On Sunday afternoon, September 3, you learn from your supervisor that Ben’s oropharyngeal swab was positive by RT-PCR for avian influenza H5N1. He is now a confirmed case. You inform the CDC and contact Ben’s parents to recommend they receive chemoprophylaxis for H5N1.

Finally on Sunday evening you manage to get a hold of Cassie. She tells you she has not been feeling well since Friday evening. She just returned from Indonesia on August 30 and thought it was just jet lag. But then she began to run a fever and subsequently developed a headache, and a cough.

Question 18 – What implications does this diagnosis have for potential human-to-human transmission of avian influenza?

Suggested answer – *The potential for human to human transmission depends on Cassie’s exposures. If Cassie had no high risk exposures except for being in close contact with Ben, this lends credibility to possible human-to-human transmission by way of excluding other possibilities. If this is the case, rapid follow-up will need to be performed for all of Ben’s close contacts, including family members, medical practitioners, and passengers on the plane he took to return from Indonesia. These contacts should be monitored for symptoms for*

10 days; prophylactic treatment should be given if transmission to other humans is deemed to be a real risk. Ben's advisor and potentially others working on the project could also be at risk of having the infection and importing it back to the United States. CDC would become involved to assist in reaching all contacts and advising on isolation or quarantine measures. A rapid response is vital, as it could lead to containment of the infection to those individuals already exposed.

Question 19 – What would you recommend Cassie do? What kind of follow up (case or contact) would you conduct for Cassie?

Suggested answer – *Cassie should seek medical attention immediately as she is showing signs and symptoms of avian influenza H5N1 infection and has had contact with a confirmed case of H5N1. You should coordinate with Cassie and her primary care physician to have her admitted in an isolation room immediately and have her treatment with a neuraminidase inhibitor begin immediately upon hospitalization.*

Cassie should be followed up as a suspect case. She needs to be interviewed to determine her exposures, and contact tracing should be conducted for those individuals she had close contact within 10 days of symptom onset. The WHO SEARO and the CDC Division of Global Migration and Quarantine should also be notified of this case.

Question 20 – Now that Ben is a confirmed case of avian influenza H5N1 and you are following up with Cassie's contacts, what other actions do you need to take?

Suggested answer –

- *Should follow up with Dr. Patel and other providers of care to Ben and Cassie as contacts and make sure they are provided with literature on how to self monitor and to follow infection control measures*
- *Will need to work with national authorities to follow up with Stargaze airlines and passengers on board Ben's flight*
- *Notify all relevant parties of this new case*
- *Make sure literature is given to health care providers*
- *Discuss alerting healthcare providers in the area about the confirmed case through channels such as CDC's Health Alert Network, EpiX, or other means of rapid dissemination*
- *Issue press release informing the public*
- *Enhance surveillance activities, and conduct active surveillance such as record reviews in health care facilities, among health care workers, and in communities*

Discussion Question – What non-pharmaceutical interventions do you recommend, if any, to protect the community? What single over-riding communications objective (“SOCO”) do you want to communicate to the public?

Suggested answer – *Encourage the group to share what interventions and messages they think would be appropriate in this situation. Non-pharmaceutical interventions that might be recommended include home quarantine of cases and possibly contacts. The group may want to discuss community mask use and/or voluntary social distancing.*

The community should be informed of correct information:

- *There has been one confirmed case of H5N1 in a person who has traveled in SE Asia*
- *Human-to-human transmission has not been established nor ruled out*
- *Simple procedures can be taken to protect yourself from influenza and other viruses (hand hygiene, cough hygiene, stay home when you are sick, etc).*

Case Study 3 Conclusion

During the following week, Ben’s respiratory symptoms improved and the fever and diarrhea resolved. Less than a week later he recovered, but was kept in isolation.

Unfortunately, Cassie’s condition deteriorated rapidly. Four days after being hospitalized, Cassie died of multi-organ failure. Tests for avian influenza H5N1 were positive.

No other cases of influenza were found among contacts of Ben or Cassie. Whether the Indonesian cases of H5N1 were transmitted from person to person, or directly from infected birds, was never able to be determined. Possible exposure to poultry or poultry products was never documented for Cassie. It is suspected that Ben and Cassie were infected through person to person transmission.

Appendix A Case Management: WHO Avian Influenza Case definitions as of August 29, 2006

Person under investigation

A person whom public health authorities have decided to investigate for possible H5N1 infection.

Suspected H5N1 case

A person presenting with unexplained acute lower respiratory illness with fever ($>38^{\circ}\text{C}$) and cough, shortness of breath or difficulty breathing.

AND

One or more of the following exposures in the 7 days prior to symptom onset:

- a. Close contact (within 1 metre) with a person (e.g. caring for, speaking with, or touching) who is a suspected, probable, or confirmed H5N1 case;
- b. Exposure (e.g. handling, slaughtering, defeathering, butchering, preparation for consumption) to poultry or wild birds or their remains or to environments contaminated by their faeces in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month;
- c. Consumption of raw or undercooked poultry products in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month;
- d. Close contact with a confirmed H5N1 infected animal other than poultry or wild birds (e.g. cat or pig);
- e. Handling samples (animal or human) suspected of containing H5N1 virus in a laboratory or other setting.

Probable H5N1 case (notify WHO)

Probable definition 1:

A person meeting the criteria for a suspected case

AND

One of the following additional criteria:

- a. infiltrates or evidence of an acute pneumonia on chest radiograph plus evidence of respiratory failure (hypoxemia, severe tachypnea)

OR

- b. positive laboratory confirmation of an influenza A infection but insufficient laboratory evidence for H5N1 infection.

Probable definition 2:

A person dying of an unexplained acute respiratory illness who is considered to be epidemiologically linked by time, place, and exposure to a probable or confirmed H5N1 case.

Confirmed H5N1 case (notify WHO)

A person meeting the criteria for a suspected or probable case

AND

One of the following positive results conducted in a national, regional or international influenza laboratory whose H5N1 test results are accepted by WHO as confirmatory:

- a. Isolation of an H5N1 virus;
- b. Positive H5 PCR results from tests using two different PCR targets, e.g. primers specific for influenza A and H5 HA;
- c. A fourfold or greater rise in neutralization antibody titer for H5N1 based on testing of an acute serum specimen (collected 7 days or less after symptom onset) and a convalescent serum specimen. The convalescent neutralizing antibody titer must also be 1:80 or higher;
- d. A microneutralization antibody titer for H5N1 of 1:80 or greater in a single serum specimen collected at day 14 or later after symptom onset and a positive result using a different serological assay, for example, a horse red blood cell haemagglutination inhibition titer of 1:160 or greater or an H5-specific western blot positive result.

Appendix B Case Management: Template for case report form
Case report form - Influenza A/H5

Case unique identifier (02_id)

1. Reporting details

Name of reporting Country or Territory (01_country)

Date of report to National Health Authorities (dd/mm/yyyy)

____/____/____

Contact details of person submitting the report

Name

Institution/Organization

Address

Telephone

Fax

E-mail

First administrative level from where person was reported (03_geo01)

(defined as first public health jurisdictional level below the national level)

Second administrative level from where person was reported (03_geo02)

(defined as second public health jurisdictional level below the national level)

City/town/village from where person was reported (03_geo03)

Date that person first came to the attention of local public health authorities

(dd/mm/yyyy) (04_d_rep)

____/____/____

2. Demographic details

Sex (05_sex)

Male ☐ Female ☐

Unknown ☐

Date of birth (dd/mm/yyyy) (06_dob)

____/____/____

Age (06_age)

(06_unit)

expressed in

Years ☐

Months ☐

Current contact details

Full address

Country

Telephone _____ Fax _____

 Nationality _____
 Ethnicity _____

3. Signs and symptoms

Date of onset of illness (dd/mm/yyyy) (**07_d_ons**)

____/____/____

Body temperature higher than 38°C

Yes ☐ No ☐

Unknown ☐

Cough

Yes ☐ ***No*** ☐

Unknown ☐

Sore throat

Yes ☐ ***No*** ☐

Unknown ☐

Shortness of breath

Yes ☐ No ☐

Unknown ☐

4. History of admission to hospital

Has the person been admitted to hospital (**08_adm01**) Yes ☐ No ☐ Unknown ☐

If Yes, complete table³ below

Note: If the person became ill while in hospital, include these details of this hospital stay under Hospital 01 in the table. Under these circumstances the date of admission should precede the date of onset of symptoms.

	Name of the hospital or hospital identifier	Second administrative level where hospital is located	Date of admission to hospital (08_d_adm01) (dd/mm/yyyy)	Has the person been isolated or cohorted	Date isolated or cohorted (dd/mm/yyyy)	Date person discharged from hospital ⁴ (dd/mm/yyyy)
Hospital 01				Yes ☐ No ☐ Unknown ☐		
Hospital 02				Yes ☐ No ☐ Unknown ☐		
Hospital 03				Yes ☐ No ☐ Unknown ☐		
Hospital 04				Yes ☐ No ☐ Unknown ☐		
Hospital 05				Yes ☐ No ☐ Unknown ☐		

To be completed ONLY once

Termination date of hospital stay (correspond to date of discharge from **final** hospital, or date of death) (dd/mm/yyyy) (**08_d_dis**)

____/____/____

During any of the hospital admissions was the person:

Isolated or cohorted (**08_iso**) Yes ☐ No ☐ Unknown ☐

If Yes, date of isolation in **final** hospital (dd/mm/yyyy) (**08_d_iso**)

____/____/____

Mechanically ventilated (**08_vent**) Yes ☐ No ☐ Unknown ☐

Admitted to an intensive care unit Yes ☐ No ☐ Unknown ☐

³ Add as many lines as needed to accommodate all hospitals in which the case was admitted

⁴ Date case discharged from hospital: this corresponds to the date of discharge OR date of transfer OR date of death

5. Travel history

During the 7 days prior to the onset of symptoms, did the person travel to or reside **outside** the reporting country or territory (**09_abroad**) Yes ☐ No ☐ Unknown ☐

If Yes, complete itinerary in table⁵ below

Place of departure	Country/ territory of departure	HPAI outbreak reported in the animal populations of country/territory of departure	Date of departure (dd/mm/yyyy)	Primary means of transport 1. Plane 2. Boat 3. Train 4. Bus 5. Other	Place of arrival	Country/ territory of arrival	HPAI outbreak reported in the animal populations of country/territory of arrival	Date of arrival (dd/mm/yyyy)
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	
		Yes ☐ No ☐ Unknown ☐					Yes ☐ No ☐ Unknown ☐	

Note: Although detailed information contained in this table is not included in the line listing, WHO may request for it to be made readily available should it be needed for international outbreak control purposes.

⁵ Add as many lines as needed to accommodate all places visited

During the 7 days prior to the onset of symptoms, did the person travel to or reside in areas **within** the reporting country or territory? Yes ☐ No ☐ Unknown ☐

If Yes, complete itinerary in table⁴ below

Area of departure (Second administrative level)	HPAI outbreak reported in the animal populations of area of departure	Date of departure (dd/mm/yyyy)	Primary mean of transport 1. Plane, 2. Boat, 3. Train, 4. Bus, 5. Other	Area of arrival (Second administrative level)	HPAI outbreak reported in the animal populations of area of arrival	Date of arrival (dd/mm/yyyy)
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	
	Yes ☐ No ☐ Unknown ☐				Yes ☐ No ☐ Unknown ☐	

⁴ Add as many lines as needed to accommodate all places visited

6. Occupational exposure

During the 7 days prior to the onset of symptoms, has the person been working:

6a In an ^{t-risk} animal-related occupation⁵ (**10_occ_an**) Yes ☐ No ☐ Unknown ☐

6b As a worker in laboratory where samples are tested for influenza A/H5 viruses (**10_occ_lab**) Yes ☐ No ☐ Unknown ☐

6c As a health care worker (**10_occ_hcw**) Yes ☐ No ☐ Unknown ☐

7. History of exposure to animal populations

During the 7 days prior to the onset of symptoms, has the person:

	<i>7a</i>	<i>7b</i>	<i>7c</i>
	Contact (within 1 metre) with any live or dead animal of species listed	Entered settings where animal species were confined or had been confined in the previous six weeks	If Yes to 7a or 7b, and exposure occurred outside the reporting country/territory, list all countries/territories where these exposures occurred
Domestic fowl ⁶	Yes ☐ No ☐ Unknown ☐ (11a_fowl)	Yes ☐ No ☐ Unknown ☐ (11b_fowl)	(11c_fowl) _____ _____ _____
Wild birds	Yes ☐ No ☐ Unknown ☐ (11a_wild)	Yes ☐ No ☐ Unknown ☐ (11b_wild)	(11c_wild) _____ _____ _____
Swine	Yes ☐ No ☐ Unknown ☐ (11a_swine)	Yes ☐ No ☐ Unknown ☐ (11b_swine)	(11c_swine) _____ _____ _____

⁵ At-risk animal-related occupations include occupations such as, domestic fowl or swine farm worker, domestic fowl processing plant worker, domestic fowl culler (catching birds, bagging birds, transporting birds, disposing of dead birds), worker in live animal market, chef working with live or recently killed domestic fowls, dealer or trader of pet birds.

⁶ Domestic fowl are birds that are commonly reared for their flesh, eggs, or feathers, and kept in a yard or similar enclosure, including chickens, ducks, geese, turkeys, guinea-fowls.

8. History of exposure to human cases

During the 7 days prior to the onset of symptoms, has the person been in contact (within touching or speaking distance) with:

8a A confirmed human case of influenza A/H5 infection (**12_cont_c**) Yes ☐ No ☐
Unknown ☐

If Yes, indicate unique identifier of confirmed case identified in 8.a. (**12_cont_id**)

8b A person with an unexplained acute respiratory illness
that later resulted in death (**12_cont_dth**) Yes ☐ No ☐
Unknown ☐

8c Any other person for whom diagnosis of influenza A/H5
is being considered⁷ (**12_cont_x**) Yes ☐ No ☐
Unknown ☐

8d If Yes to 8a or 8b or 8c, the person is part of a ^{cluster}⁸,
tick “Applicable” (**13_clus**) Applicable ☐ Not applicable ☐

8e If Applicable, is the cluster: Already known ☐ , indicate cluster identifier⁹ in 8f
Newly identified ☐ , assign and indicate cluster⁹ identifier in 8f

8f Indicate cluster identifier⁹ (**13_clus_id**) _____

What is the setting of this cluster (**13_clus_sett**)

Household	☐
Extended family	☐
Hospital	☐
Other residential institution	☐
Military barracks	☐
Recreational camps	☐
Other	☐ , specify

⁷ a person for whom diagnosis of influenza A/H5 viral infection is being considered: include all case categories that are not confirmed.

⁸ A “cluster” is defined as two or more persons for whom the diagnosis of influenza A/H5 is being considered (including those persons who have died of an unexplained acute respiratory illness) with onset of symptoms within the same two-week period and who are associated with a specific setting such as a household, extended family, hospital, other residential institution, military barracks, or recreational camp.

⁹ Cluster identifier: Suggested to use unique identifier of the first identified case in the cluster as cluster identifier.

Summary of exposure history

No reported at-risk animal exposure and no laboratory occupational exposure (**14_no_an**):

tick “Applicable” if “**No**” to **6.a.**, and **6.b.**, and **all 7.a.**, and **all 7.b.**

Applicable ☐

Not applicable ☐

Exposure history is unknown or undetermined (**14_ukn**):

Tick “Applicable” if “**Unknown**” or **blank** to all the following items: **6.a.**, and **6.b.**, and **6.c.**, and **all 7.a.**, and **all 7.b.**, and **8.a.**, and **8.b.**, and **8.c.**

Applicable ☐

Not applicable ☐

9. Laboratory investigation results

Positive influenza A by rapid test

Yes ☐ No ☐

Unknown ☐

High influenza A/H5 specific antibodies detected in a single serum specimen

Yes ☐ No ☐

Unknown ☐

If Yes, indicate titre _____

Positive viral culture for influenza A/H5 (**15_cultH5**)

Yes ☐ No ☐

Unknown ☐

Positive polymerase chain reaction (PCR) for influenza A/H5 (**15_pcrH5**)

Yes ☐ No ☐

Unknown ☐

Positive immunofluorescence antibody (IFA) test for H5 antigen using
H5 monoclonal antibodies (**15_ifaH5**)

Yes ☐ No ☐

Unknown ☐

4-fold rise in H5-specific antibody titre in paired serum samples (**15_seroH5**)

Yes ☐ No ☐

Unknown ☐

Has influenza A/H5 virus subtype been identified

Yes ☐ No ☐

Unknown ☐

If Yes, specify (**15_subtype**) _____

Were samples or isolates sent for further confirmation to a WHO reference laboratories for diagnosis of
influenza A/H5 infection¹⁰ (**15_reflab**)

Yes ☐ No ☐

Unknown ☐

If Yes, indicate laboratory:

National Institute of Infectious Diseases, Japan

Yes ☐ No ☐

Unknown ☐

Centers for Disease Control and Prevention, US

Yes ☐ No ☐

Unknown ☐

National Institute for Medical Research, UK

Yes ☐ No ☐

Unknown ☐

St. Jude Children's Research Hospital, US

Yes ☐ No ☐

Unknown ☐

¹⁰ See Annex 6: *WHO reference laboratories for diagnosis of influenza A/H5 infection*

National Influenza Center - Government Virus Unit
Hong Kong - SAR China

Yes ☐ No ☐
Unknown ☐

The University of Hong Kong, Queen Mary Hospital
Hong Kong - SAR China

Yes ☐ No ☐
Unknown ☐

Institut Pasteur, France

Yes ☐ No ☐
Unknown ☐

Other

Yes ☐ No ☐
Unknown ☐

If Yes , specify _____

10. Prophylaxis against influenza

Was the person vaccinated against influenza in the 6 months prior to the onset of symptoms

Yes ☐ No ☐

Unknown ☐

If Yes, in which country _____

During the 7 days prior to the onset of symptoms has the person been taking any of the following medications

	Medication		Was the medication taken every day during this 7 day period
Oseltamivir phosphate (Tamiflu®)	Yes ☐ No ☐ Unknown ☐	If Yes,	Yes ☐ No ☐ Unknown ☐
Zanimivir (Relenza ®)	Yes ☐ No ☐ Unknown ☐		Yes ☐ No ☐ Unknown ☐
Amantadine (Symadine ®, Symmetrel ®)	Yes ☐ No ☐ Unknown ☐		Yes ☐ No ☐ Unknown ☐
Rimantadine (Flumadine ®)	Yes ☐ No ☐ Unknown ☐		Yes ☐ No ☐ Unknown ☐

11. Final disposition (16_disp) To be completed ONLY once

Recovered ☐ (Recovered includes persons discharged from hospital)
Deceased ☐
Lost to follow-up ☐ (Lost to follow-up includes persons lost to follow-up while still infectious)

Date final status was determined (dd/mm/yyyy) (16_d_disp) ____/____/____

For deceased persons ONLY

If person deceased, date of death (dd/mm/yyyy) (17_d_dead)

____/____/____

12. Case classification

Initial case classification Date initial case classification (dd/mm/yyyy) ____/____/____
Confirmed ☐
Probable ☐
Possible ☐
Under investigation ☐

Interim Case Classification (18_i_class)

Date case classification assigned (dd/mm/yyyy)
Confirmed ____/____/____
Probable ____/____/____
Possible ____/____/____
Under investigation ____/____/____
Discarded ____/____/____

Final case classification (19_fin_class)

Confirmed ☐
Probable ☐
Possible ☐
Under investigation ☐
Discarded ☐ (Discarded cases should remain in the data set)

Date final case classification (dd/mm/yyyy) (19_fin_class) ____/____/____

Module 6

Laboratory Diagnostics

Presentation Handouts

Exercises

Background Information

Laboratory Diagnostics

Presentation Handouts

Laboratory Diagnostics, Specimen Collection, and Biosafety Issues

In this module we will talk about laboratory diagnostics, specimen collection, and biosafety issues related to avian influenza. For the first hour, we will review basic information. You will then practice taking clinical specimens and interpreting laboratory data.

Learning Objectives

- Prepare and maintain collection kits
- Collect and transport specimens safely and correctly
- Manage laboratory specimens safely
- Interpret laboratory data

By the end of this module, you should be able to:

- Prepare and maintain specimen collection kits
- Collect and transport specimens safely and correctly
- Manage laboratory specimens safely
- Interpret laboratory data.

The Specimen Collection Kit

The first topic that we will discuss in this module is the specimen collection kit. The specimen collection kit contains the supplies you will need to safely collect samples from suspected cases of avian influenza.

Specimen Collection Kit

- Collection vials with VTM
- Polyester fiber-tipped applicators
- Sterile saline (0,85% NaCl)
- Sputum or mucus trap
- Tongue depressors
- Specimen collection cups or Petri dishes
- Transfer pipettes
- Secondary container
- Ice packs
- Items for blood collection
- Personal protective equipment
- Field collection forms
- A pen or marker for labeling samples

Here is a checklist of all items that should be in the specimen collection kit. The items include:

- Collection vials with VTM, which is a chemical stabilizer for storing and transporting clinical specimens,
- Polyester fiber-tipped applicators
- Sterile saline which is 0,85% NaCl
- A sputum or mucus trap
- Tongue depressors
- Specimen collection cups or Petri dishes
- Transfer pipettes
- A secondary container
- Ice packs
- Items for collection of blood
- Personal protective equipment
- Field collection forms
- A pen or marker for labeling samples

How to Manage Kits

- Store specimen collection kits in a dry, cool place
- Store specimen collection kit where it will be accessible after hours and on weekends

The items in the specimen collection kit should be kept together, except for collection vials containing VTM which should be kept in the freezer. As much as possible, the specimen collection kit should be kept in a dry, cool place. In addition, it must be accessible after hours and on weekends, in case you need to leave for the field at these times.

How to Safely And Correctly Collect Samples

Now we will move on to how to safely and correctly *collect* samples.

Clinical Specimen Sources

Be prepared to collect specimens before you leave for the field

- Suspected cases
 - Symptoms consistent with influenza
- Contacts
 - Including people living or working with suspected cases

You should plan on the need to collect specimens before you leave for the field, so that you are prepared when you arrive. Prepare the needed materials beforehand.

Specimen samples need to be collected from both suspected cases and their contacts. Suspected cases are people with symptoms consistent with an influenza illness. Contacts are people with direct contact with suspected cases, such as people who live or work with them.

What to Collect

Preferred specimens

- Oropharyngeal swabs
- Lower respiratory tract specimens
 - Bronchoalveolar lavage or tracheal aspirates

Other specimens

- Nasal swab
- Nasopharyngeal swabs

Collect the sample on several different days

You can collect several clinical specimens to determine whether an illness is caused by avian influenza. You can use respiratory specimens or serological samples. It is best to collect both, if possible.

Oropharyngeal swabs and lower respiratory tract specimens (e.g., bronchoalveolar lavage or tracheal aspirates) are preferred because they may have the highest yield for influenza H5N1 detection, as determined on the basis of available data. However, lower respiratory specimens are difficult to collect when the patient is not intubated. Nasal swabs, nasopharyngeal swabs, and nasal aspirate are acceptable but may have lower yield. We will discuss how to collect oropharyngeal, nasopharyngeal, and nasal aspirate samples later in this presentation. You should collect as many types of specimens as possible.

If you collect serological samples, both acute serum or convalescent serum should be collected.

It is important that the samples are collected more than once. Collect samples on several days throughout the investigation of the patient.

When to Collect Respiratory Specimens

- As soon as possible after symptoms begin
- Before antiviral medications are administered
- Even if symptoms began more than one week ago
- Collect multiple specimens on multiple days

Influenza virus is most likely to be detected soon after symptoms begin. Therefore, in order to increase the chances that the laboratory can detect the H5 virus, respiratory samples should be collected as soon as possible after symptoms begin and before antiviral medications are administered. However, it is not always logistically possible to collect respiratory samples early in the clinical course of disease. But you can still collect specimens even if the symptoms began more than a week ago, as it is still possible to detect virus in these specimens.

It is best to collect multiple types of specimens on multiple days.

Personal Protective Equipment

- Masks (N-95 or N/P/R-100)
- Gloves
- Protective eye ware (goggles)
- Hair covers
- Boot or shoe covers
- Protective clothing (gown or apron)

Regardless of the type of specimen that you collect—either respiratory or serological—when you collect clinical specimens from people who might have avian influenza, it will be important to follow safety precautions. Be sure that you wear personal protective equipment such as N-95 respirator or N/P/R-100 face masks, gloves, and protective eye ware. You should also wear hair covers, boot or shoe covers, and protective clothing such as a gown or apron.

Field Data Collection Form

- Patient name
- Unique identification number
- Patient demographic information
- Patient's health status

For every specimen collected, record the patient's name and unique identification number. You will also collect information about the patient's health status and demographic information on a "field data collection form." This information can be very useful when you conduct an epidemiological investigation of the source of the infection. The information can also help you identify potential contacts.

Specimen Tracking System

Maintain a database to track:

- Identification number
- Subject information
- Specimen collection date
- Specimen collection location
- Diagnostic test results

You will need to use a specimen tracking system to keep track of the specimens at all times. The particular specimen tracking system will vary by health department. However, there are some guidelines. It is advisable to maintain a database that contains information about each sample, including the identification or tracking number, subject information, and when and where a sample was collected. Results from diagnostic testing should also be entered into the database.

Specimen Storage, Handling, and Transportation

We are next going to discuss considerations for storing, handling, and transporting the specimens that you collect. This may be the most important task related to specimens that you as a rapid responder will perform.

How to Store Specimens

- For specimens in VTM:
 - Transport to laboratory as soon as possible
 - Store specimens at 4 °C before and during transportation within 48 hours
 - Store specimens at -70 °C beyond 48 hours
 - Do not store in standard freezer – keep on ice or in refrigerator
 - Avoid freeze-thaw cycles
 - Better to keep on ice for a week than to have repeat freeze and thaw

Although you should send specimens in Viral Transport Medium (VTM) to the laboratory as soon as possible, it is important to properly store them before you send them to a laboratory. If you will be transporting specimens within 48 hours, you can store them at 4 °C both before *and* during transportation. If you will not be able to transport the specimens to the laboratory within 2 days, you need to store them at -70 °C. If this can't be done, keep the specimens on ice or in the refrigerator as long as necessary. DO NOT put specimens in a standard freezer, as this will damage them.

It is also very important to avoid freeze-thaw cycles. Do not freeze samples if they will thaw and be frozen again, as this will destroy the virus. It is better to keep a sample on ice even for a week, than to allow the sample to freeze and thaw multiple times.

How to Store Specimens

For sera:

- Store specimen at 4 °C
- For both VTM specimens and sera, avoid repeated freeze-thaw cycles

Storage conditions for sera (which is derived from the blood sample) are slightly different. Sera can be stored at 4 °C. For both VTM specimens and sera, avoid repeated freeze-thaw cycles.

Packing Specimens for Transportation

- Keep specimens at 4 °C
 - Fill a cooler with ice packs or coolant packs
 - Double-bag specimens if you use dry ice
- Include an itemized list of specimens with identification numbers and laboratory instructions

Just as it is important to keep specimens cold during storage, it is important to keep specimens cold during *transportation*. Try to keep specimens at 4 °C. A cooler filled with ice packs can be used for this purpose, but do not use dry ice unless the specimens are double-bagged and airtight; carbon dioxide from the dry ice can inactivate the virus.

In all specimen shipments, include an itemized list of specimens, with specimen identification numbers and instructions for the laboratory.

Transporting Specimens

- Initial testing at State Public Health Laboratory
- Call CDC Hotline before sending specimens for reference testing **770-488-7100**
- Send Priority Overnight
- Include inventory sheet and CDC case ID number
- Coordinate with the laboratory

When you send any specimens from potential cases of avian influenza from the field to a laboratory, we recommend that you follow WHO guidelines which are outlined here for the safe transport of infectious substances and diagnostic specimens. In addition, you may need to follow local regulations on the transportation of infectious material.

Be sure to coordinate the shipment with the laboratory. Arrangements should be made so that the laboratory is prepared to receive the specimens when they arrive. The initial test will be conducted at your state Public Health Laboratory. Confirmatory testing for positives can then be conducted at CDC.

State and local health departments should call the CDC Emergency Response Hotline (770-488-7100) before sending specimens for influenza A reference testing. This number is available 24 hours a day, 7 days a week. Hotline staff will notify a member of the Influenza Division, who will contact the health department to answer questions and provide guidance. In some cases, the state health department may arrange for a clinical laboratory to send samples directly to CDC.

Specimens should be sent by Priority Overnight Shipping for receipt within 24 hours. Samples (such as fresh-frozen autopsy samples for RT-PCR or other clinical materials) may be frozen at -70 if the package cannot be shipped within a specified time (e.g., if the specimen is collected on a Friday but cannot be shipped until Monday).

When sending clinical specimens, include a specimen inventory sheet and the assigned CDC case ID number and note “Influenza surveillance” on all materials and specimens sent.

Include the CDC case ID number on all materials forwarded to CDC. Protocols for standard interstate shipment of etiologic agents should be followed (available at <http://www.cdc.gov/od/ohs/biosfty/shipregs.htm>).

Managing and Analyzing Laboratory Data

Once the specimens have been collected, packaged, transported to the appropriate laboratory, and tested, the test results will become available. So the next step is managing the information that the tests provide. In this final segment of the module, we will briefly talk about managing and analyzing laboratory data.

Data Management Rules

- Double check data entry accuracy
- Include unique identification numbers
- Keep subject names confidential
- Track testing dates and results
- Back up the database

First, we will go over some general data management rules.

- It is advisable to double check the accuracy of data entry into the database. You can do this by having two different people enter the specimen information, and then check for inconsistencies. Or, after one person has entered the data, go back and check for mistakes
- Also make sure that each data record includes a unique identification number
- Keep the names of subjects confidential
- Keep track of each test done and the results of each test
- Finally, back up the database either by printing it out or saving it to a disk

Computer Software

- Epi-info (CDC)
 - Free, at <http://www.cdc.gov/epiinfo/>
- Microsoft Excel and Access
- Oracle
- MySQL
- Filemaker Pro

You can use several types of computer software to manage and analyze laboratory data. Epi-info, which can be acquired for free from the United States Centers for Diseases Control (CDC) is one example of computer software used for database management. There are also several commercial options, including Microsoft Excel and Access, Oracle, MySQL, and Filemaker Pro.

Data Analysis Measures

Prevalence

The number of cases divided by the size of the population

Sensitivity

The number of cases identified by the test divided by the number of true positives which were identified by the gold standard technique

Specificity

The number of non-cases identified by the test divided by the number of true negatives that were identified by the gold standard technique

How you approach the analysis of your data will depend on the type of information that you have collected and the research questions being asked. Here are a few common measures used in the analysis of potential avian influenza outbreaks:

Prevalence is the number of cases divided by the size of the population.

Sensitivity is the number of cases identified by the test divided by the number of true positives which were identified by the gold standard technique. A highly sensitive test will identify most or all people who have the infection.

Specificity is the number of non-cases identified by the test divided by the number of true negatives that were identified by the gold standard technique. A highly specific test correctly identifies those who do NOT have the infection.

How to Present Results

Report:

- Time and place of the outbreak
- Prevalence of infection
- Clinical information about cases
- Epidemic curve

Share results with local health officials and CDC

Once all data have been entered, it is important to report or summarize the data analysis results in a succinct manner. The report can then be used by others who need to be informed of the progress of the outbreak. You should include the following information in a report:

- The time and place of the outbreak
- The prevalence of infection
- Clinical information about the cases
- The epidemic curve. You will learn more about creating epidemic curves in a case study later in this training

Once your report is complete, you should share your results with local health officials and the CDC.

Laboratory Tests

Next, we will briefly mention the types of laboratory tests that are available for avian influenza.

Laboratory Diagnosis for Avian Influenza

Tests for respiratory samples:

- PCR-based techniques
- Virus isolation
- Immunofluorescence
- Rapid antigen detection

Blood used for:

- Measurement of specific antibodies (sera)
- Viral isolation (whole blood)
- PCR-based techniques (sera)

Avian influenza diagnostic tests differ by specimen type, laboratory expertise, and interpretation. We will discuss several of these tests and how to interpret their results.

Tests for respiratory samples include:

- PCR-based techniques
- virus isolation
- immunofluorescence
- rapid antigen detection

Blood sera are used for the measurement of specific antibodies against the influenza virus. Whole blood might also be useful for viral isolation and sera for PCR-based techniques, but there is less evidence supporting the use of blood for these purposes. Therefore, we will only discuss the use of blood sera for measuring antibodies.

Laboratory Tests

Virus Isolation

- Gold standard for detection of avian influenza
- Technically difficult and requires BSL-3 laboratory

PCR Based Techniques

- Sensitivity depends on the particular test, the influenza strain, and the type of specimen used
 - Sensitivity: 80 - 100%
 - Specificity: 90 - 100%

We will cover a couple tests on this slide. There is more information on tests in the background materials provided in your notebook.

Virus isolation – or detecting the actual virus in a clinical sample – is the gold standard for detection of avian influenza. However, it is technically difficult and requires a BSL3 laboratory environment.

Another way to test for avian influenza is the use of PCR techniques. There are actually multiple PCR techniques that can be used. These include techniques called nested reverse transcriptase polymerase chain reaction (RT-PCR) and real-time RT-PCR. Each test determines whether a specific virus is present in the sample. Test sensitivity depends on the particular test, the influenza strain, and the type of specimen used.

When compared to the gold standard of viral culture, the PCR techniques have a sensitivity of 80 - 100% and a specificity of 90 - 100%.

Serological Tests	
Paired serum samples are most useful	
Acute sample	Within 7 days after symptom onset
Convalescent sample	More than 12 days after symptom onset

For tests based on serology, paired serum samples are more useful than serum just collected once. This is because the concentration of antibodies specific to avian influenza is hard to interpret on its own. However, when the antibody titer increases during an influenza-like illness, this is strong evidence that the illness is being caused by avian influenza. Therefore, you should take two samples if at all possible. The first sample, which is the acute sample, should be collected within 7 days of the onset of clinical symptoms. The second sample, which is the convalescent sample, should be collected more than 12 days after the onset of clinical symptoms.

Interpreting Serology Tests		
Acute Sample	Convalescent Sample	Interpretation
low	low	No evidence of Infection
low	high	Seroconversion (evidence of infection)
high	high	Inconclusive; past exposure to avian influenza possible

Let’s now look at how to interpret the paired serology tests.

When both the acute and convalescent samples have low levels of antibodies specific to avian influenza, then there is no evidence of infection.

When the acute sample has low levels of antibodies and the convalescent sample has high levels of antibodies specific to avian influenza, this is called seroconversion. It provides strong evidence of infection by avian influenza.

When the antibody levels in both the acute and convalescent sample are high and similar to each other, the test is inconclusive. Past exposure to avian influenza is possible. However, it is unlikely that the current infection is caused by avian influenza.

Summary

- Maintain adequately stocked specimen collection kits and store them properly when they are not in use.
- Oropharyngeal swabs and lower respiratory specimens are the best specimens to collect.
- Collect multiple specimens (respiratory and blood) on multiple days.

To summarize this lecture:

- Maintain adequately stocked specimen collection kits and store them properly when they are not in use
- Oropharyngeal swabs and lower respiratory specimens are the best specimens to collect.
- Collect multiple specimens (respiratory and blood) on multiple days

Summary

- Proper specimen storage, handling, and shipping is vital to a successful laboratory test.
- Keep track of information on the specimens collected in a database or logbook.
- When handling infectious materials in the laboratory or in the field, take safety precautions.
- Properly dispose of any infectious material.

- Proper specimen storage, handling, and shipping is vital keeping the virus intact for a successful laboratory test
- Keep track of information on the specimens collected in a database or logbook
- When handling infectious materials in the laboratory or in the field, take safety precautions
- Properly dispose of any infectious material whether in the lab or in the field. Incineration is the preferred method for most materials.

Summary

- Most states will be able to perform some basic influenza identification tests on a clinical specimen, but more specific testing may need to be done at a higher level national or regional laboratory.
- When you report on the progress of an outbreak investigation, share investigation results with local health officials and the CDC.

In summary, most states will be able to perform some basic influenza identification tests on a clinical specimen, but more specific testing may need to be done at a higher level national or regional laboratory.

When you report on the progress of an outbreak investigation, share investigation results with local health officials and CDC.

Laboratory Practice Exercise

This concludes the lecture for this module. Next we will have demonstrations of laboratory techniques and exercises for you to apply what you have learned.

Glossary

Centrifuge

A machine that uses high-speed rotation to separate materials with different densities.

Culture

The growing of microorganisms in a nutrient-rich medium.

Nucleic acid

A component genetic material such as DNA or RNA found in all cells in humans, animals, bacteria, and viruses. Every species and organism has a unique pattern.

Glossary

Pipette

A glass or plastic tube used to measure or transfer small amounts of liquid.

Saline

A liquid solution made of salt and water.

Viral Transport Medium (VTM)

The preservative liquid in which specimens are stored until they are tested.

References and Resources

- Recommended laboratory tests to identify avian influenza A virus in specimens from humans. World Health Organization, June, 2005.
http://www.who.int/csr/disease/avian_influenza/guidelines/avian_labtests2.pdf
- WHO guidelines for the collection of human specimens for laboratory diagnosis of avian influenza infection, 12 January 2005.
http://www.who.int/csr/disease/avian_influenza/guidelines/humanspecimens/en/index.html

Laboratory Diagnostics

Exercises

Exercise 6

Laboratory Diagnostics Practice Exercises

General Instructions:

On the pages that follow, you will work through four exercises related to laboratory diagnosis of avian influenza. Each exercise is preceded by specific instructions. A list of the exercises is provided below.

1. The sampling time frame for a suspected avian influenza case
2. Prioritizing which laboratory tests to perform
3. Analysis of laboratory data
4. Interpretation of laboratory test results

Total time allotted: 1 hour

Part 1: The Sampling Time Frame for a Suspect Avian Influenza Case

Objectives:

Determine what samples should be taken to test for avian influenza, as well as when these samples should be taken and how they should be stored.

Instructions:

Read the case study background information. Then work together as a group to develop a response to each of the discussion questions.

Time allotted: 15 minutes

Scenario

Avian influenza has been reported among wild fowl in the United States. A six year-old girl presented to a local hospital with fever, cough, and sore throat on January 2nd. She was admitted with a high fever and difficulty breathing. Her mother reported that the girl's symptoms started on January 1st. The mother also reported that both she and the girl's father work on a poultry farm managing operations.

The doctor suspected avian influenza and called you for advice.

Question 1 – What type of specimens should be collected?

Suggested Answer – The optimal choice for a patient who is not intubated is the oropharyngeal swab. If it is not possible to collect an oropharyngeal swab, other options include a nasal wash, throat swab, nasopharyngeal swab, or nasal swab. An acute blood sample should also be taken. Note that a nasopharyngeal swab would be the best specimen to collect for human influenza. Lower respiratory tract specimens are often easier to collect in patients who are intubated.

Question 2 – When should the specimens be collected?

Suggested Answer – The respiratory and acute blood serum specimens should be collected as soon as possible. All samples should be taken again in a few days, and more times, if possible. A second blood sample should be taken in about two weeks.

Question 3 – If the girl had presented at the hospital 4 days after her symptoms began, would you change your choice of what specimens to collect?

Suggested Answer – *No. Even though one is most likely to detect influenza virus when the sample is taken within 3 days of symptom onset, it is also possible to recover virus in samples taken at a later time.*

Question 4 – How should the specimens be stored before they are sent to the laboratory?

Suggested Answer – *If the specimens can be tested within 48 hours, they should be stored at 4 °C (such as in a refrigerator) until they can be transported to the laboratory. Otherwise, samples should be immediately frozen, stored at -70°C, and transported on dry ice.*

Question 5 – If there is a delay in sending the samples to the laboratory, what should you do with the samples?

Suggested Answer – *Respiratory samples should be stored in a -70 °C freezer. If a -70 °C freezer cannot be located, keep samples in the refrigerator at 4 °C. Do not put them in a normal freezer. Serum samples can be kept either in a -70 °C freezer or a normal freezer (-20 °C). The most important point is to avoid freezing and thawing the samples multiple times.*

Update

You advise the doctor on what specimens should be collected. Later that day, the doctor calls you again. He tells you that the girl's mother has refused to allow nasal swabs to be collected from her child, and that she refuses to have more samples taken over the next several days. The doctor himself does not understand why so many specimens are necessary.

Question 6 – You must explain to the doctor why multiple samples are necessary, so he can explain this to the patient's mother. What do you tell him?

Suggested Answer – *Explain to the doctor the status of avian influenza in the US (this will change over time) and the importance of correctly diagnosing avian influenza in order to contain the infection. The ability of a laboratory test to detect the virus will depend on the amount of virus present in the patient sample,*

the storage, handling, and shipping conditions of the sample, and the accuracy and correct performance of the laboratory test. With so many potential problems, it is very important to take multiple samples on multiple days. The doctor may explain to the mother that the laboratory tests will help determine the best way to treat the child and improve her illness. The doctor should find a way to work through cultural or religious sensitivities if this becomes a problem (solution will vary depending on the situation).

Part 2: Prioritizing which laboratory tests to perform

Objectives:

Determine which specimens should be collected and how they should be tested for suspect avian influenza.

Instructions:

Answer the following questions, using the previous scenario.

Time allotted: 10 minutes

Question 1 – What type of specimen is most important for the diagnosis of avian influenza?

***Suggested Answer** – Respiratory specimens are the most important because the presence of the virus can be directly measured. However, multiple samples (different types of respiratory samples as well as blood) should be collected on multiple days.*

Question 2 – What particular test would you use for the respiratory samples?

***Suggested Answer** – The answer to this question depends on the laboratory resources available in your area; please adapt the answer accordingly. Viral isolation is considered the most definitive, but this technique takes time and it requires BSL3 facilities. Molecular techniques and immunofluorescence are faster and do not require BSL3 facilities.*

Question 3 – How should the hospital dispose of the materials used to collect the sample?

***Suggested Answer** – Disposable materials should be destroyed in the hospital incinerator.*

Update

Having agreed to the testing of her sick child, the mother is now worried that her 2 other children may also get the illness and asks that these children be tested for avian influenza as well.

Question 4 – Should you recommend that samples be taken from the other children in the household?

Suggested Answer – *Under most circumstances, other family members or exposed persons would ONLY be tested if they have influenza symptoms. If they do not have symptoms, ask the family to carefully monitor the health status of the other children and family members. They should report to the doctor if they begin any coughing or respiratory symptoms. They would be tested at that time.*

Question 5 – Will you recommend that the chickens on the farm where the parents work be tested?

Suggested Answer – *The chickens should be tested. You should coordinate with the appropriate state veterinary department and/or environmental health department to take samples.*

Part 3: Analysis of laboratory data

Objectives:

Practice analyzing and reporting avian influenza laboratory data.

Instructions:

Read the information given below and review the data table provided. Then answer the questions that follow.

Time allotted: 15 minutes

Background

As a result of an outbreak investigation of avian influenza, respiratory specimens were collected from 20 different people exposed to dead chickens in a major poultry farming area. The respiratory specimens were tested for the presence of the H5 virus using real-time RT-PCR. Test results are summarized in the table below.

Subject	Contact with dead chickens?	Age	Test Result
1	no	55	-
2	yes	10	+
3	yes	23	-
4	no	65	-
5	no	22	-
6	no	45	+
7	no	5	+
8	yes	10	+
9	no	45	-
10	no	70	-
11	no	23	-
12	no	30	-
13	no	32	-
14	no	17	-
15	no	21	-
16	yes	55	-
17	yes	41	+
18	no	80	-
19	no	21	-
20	no	11	-

Question 1 – How would you report the results?

Suggested Answer – *One way to report the results is as they are listed above. However, this is difficult to read. A summary report that shows the people who have contact with dead chickens and whether or not they tested positive might be most useful. Providing an age range of those testing positive would also be helpful. See the example given below:*

Number of people tested: 20

Number of people testing positive: 5 (age range 5 years – 45 years)

Of those testing positive, 3 (60%) had contact with dead chickens.

Question 2 – What is the prevalence of infection?

Suggested Answer – $\text{Prevalence} = \# \text{ testing positive} / \text{total} \# \text{ people} = 5 / 20 = 25\%$

Question 3 – What is the prevalence of infection by exposure to dead chickens?

Suggested Answer – $\text{Prevalence} = \# \text{ testing positive with exposure} / \text{total} \# \text{ exposed} = 3 \text{ positive exposed} / 5 \text{ exposed} = 60\%$

Question 4 – Is the infection more common in children or adults?

Suggested Answer – *The infection is slightly more common in children – 3 children tested positive, and 2 adults tested positive.*

Part 4: Interpretation of laboratory test results

Objectives:

Examine and interpret the results from several different laboratory tests for avian influenza.

Instructions:

Three rounds of laboratory test results from patients with suspected avian influenza are presented below. Examine the results given, and provide the interpretation of each sample in the table.

Time allotted: 20 minutes

***Facilitator** – Allow the students about 15 minutes to complete their responses. They may work with a partner or in small groups, and may consult the lecture slides to form their answers. After most people are finished, ask for volunteers to provide the answers, and tell them whether they are correct. If answers are incorrect, provide and explain the correct answers.*

Laboratory Test 1

Here are the results from six different real-time RT-PCR assays. Individual tests were used to determine if the clinical sample contained A, A/H1, A/H3, A/H5 and B, viruses. Interpret the results for each sample in the far right column of the table.

	A	H1	H3	H5	B	Positive Control	Negative Control	Interpretation?
Sample A	-	-	-	-	+	+	-	
Sample B	+	+	-	-	-	+	-	
Sample C	+	-	-	+	-	+	-	
Sample D	-	-	-	-	-	-	-	

Question 1 – How would you interpret these results?

Suggested Answer –

Sample A Influenza B (not avian)

Sample B Influenza A H1 (probably a human strain)

Sample C Influenza A, H5 (avian influenza)

Sample D Inconclusive

Laboratory Test 2

Below are the results of the haemagglutination inhibition test, which determines if antibodies present in serum are specific to avian influenza. Paired samples (acute and convalescent) were taken for each of three subjects. Paired samples will show if the subject has had a recent infection, because antibodies to the infection will increase greatly between the first sample and the second. The relative concentrations of antibodies specific to avian influenza in the acute and convalescent phases are presented below. Determine whether there is evidence that any of the subjects were exposed to avian influenza, and note your interpretation of the test results in the far right column of the table.

	Acute	Convalescent	Interpretation?
Subject A	high	high	
Subject B	low	high	
Subject C	low	low	

Question 2 – How would you interpret these test results?

Suggested Answer –

Subject A Evidence of past exposure to H5 influenza

Subject B Evidence that clinical disease was caused by H5 influenza

Subject C No evidence of H5 infection

Laboratory Test 3

A nasopharyngeal aspirate from a suspected avian influenza case was tested using a commercially available rapid influenza test for influenza A. The result was positive.

Question 3 – How would you interpret the results? Are any other tests necessary?

***Suggested Answer**– A positive result for a rapid test for influenza A just means that influenza A is present. This influenza A virus could be a human strain or an avian strain. Therefore, additional testing is needed. Molecular testing, immunofluorescence, or viral culture could be used to further test the specimen.*

Laboratory Diagnostics

Background Information

Laboratory Diagnostics, Specimen Collection, and Biosafety Issues

1

In this module we will talk about laboratory diagnostics, specimen collection, and biosafety issues related to avian influenza. For the first hour, we will review basic information. You will then practice taking clinical specimens and interpreting laboratory data.

Learning Objectives

- Prepare and maintain collection kits
- Collect and transport specimens safely and correctly
- Manage laboratory specimens safely
- Interpret laboratory data

2

By the end of this module, you should be able to:

- Prepare and maintain specimen collection kits
- Collect and transport specimens safely and correctly
- Manage laboratory specimens safely
- Interpret laboratory data.

Session Overview

- Specimen collection
- Specimen storage, handling, shipping
- Safety precautions in the laboratory
- Working with reference laboratories
- Managing laboratory data

3

In this session, we will begin by talking about specimen collection, starting with the materials needed to collect specimens. We will then talk about which specimens to collect for suspected avian influenza patients, and how to collect them. After specimens are collected, you will need to know how to store, handle, pack, and ship them to a laboratory. We will go through each of these steps. At times, there may be a need to dispose of infectious waste in the field, so we will discuss the best methods of accomplishing this. Finally, we will discuss safety precautions for the laboratory, the available reference laboratories that perform definitive tests on the patient specimens, and how to manage laboratory data.

Facilitator Note: *Additional slides containing more technical content on specific laboratory tests for avian influenza are also available in the appendix.*

The Specimen Collection Kit

4

The first topic that we will discuss in this module is the specimen collection kit.

Specimen Collection Kit

- Preparing the specimen collection kit
- Managing the specimen collection kit

5

The specimen collection kit contains the supplies you will need to safely collect samples from suspected cases of avian influenza. Specifically, we will talk about preparing the specimen collection kit and managing the specimen collection kit.

Specimen Collection Kit

- | | |
|--|--|
| • Collection vials with VTM | • Secondary container |
| • Polyester fiber-tipped applicators | • Ice packs |
| • Sterile saline (0.85% NaCl) | • Items for blood collection |
| • Sputum or mucus trap | • Personal protective equipment |
| • Tongue depressors | • Field collection forms |
| • Specimen collection cups or Petri dishes | • A pen or marker for labeling samples |
| • Transfer pipettes | |

6

Here is a checklist of all items that should be in the specimen collection kit. The items include:

- Collection vials with VTM
- Polyester fiber-tipped applicators
- Sterile saline which is 0.85% NaCl
- A sputum or mucus trap
- Tongue depressors
- Specimen collection cups or Petri dishes
- Transfer pipettes
- A secondary container
- Ice packs
- Items for collection of blood
- Personal protective equipment
- Field collection forms
- A pen or marker for labeling samples

Let's look more closely at a few of these items. . .

Polyester Fiber-Tipped Applicator



- Should be drayon, rayon, or polyester fiber swabs
- Do *not* use calcium alginate or cotton swabs nor ones with wooden sticks; they inhibit PCR

7

These are polyester fiber-tipped applicators. They are used in collecting specimens from the nose, nasopharynx, or throat. The applicators should have drayon, rayon, or polyester fiber swabs. Do not use calcium alginate or cotton swabs, nor ones with wooden sticks since they inhibit a laboratory test called PCR. Also, individually wrapped applicators are preferable to ensure they are sterile.

15 ml Conical Centrifuge Tubes



8

This is a 15 ml conical centrifuge tube. This item might be needed for centrifuging blood if a serum specimen needs to be processed.

Specimen Collection Cups and Petri Dishes



collection cups

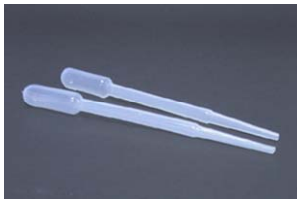


petri dishes

9

These are specimen collection cups and petri dishes. Either can be used when you collect nasal washes, but only one type is needed. Petri dishes should not be used to transport any specimen that may leak.

Transfer Pipettes



10

These are transfer pipettes. They are used in processing samples in the field.

Phlebotomy Supplies

- Tourniquet
- Disposable needles
- Vacuum tubes with EDTA
- Plastic needle holder
- Alcohol and iodine swabs
- Gauze
- Band-aids
- Biohazard sharps container



11

These are the supplies needed for collecting blood. The items that you need include a tourniquet, disposable needles, vacuum tubes with EDTA (EDTA is a chemical used in laboratory solutions), a plastic needle holder, alcohol and iodine swabs, gauze, band-aids, and a biohazard sharps container.

Personal Protective Equipment

- Gloves
- Mask
- Gown
- Eye protection



12

Personal protective equipment such as gloves, masks, gowns, and eye protection should also be included in the specimen collection kit. Multiple sizes of the gloves and masks should be available to assure that the people collecting the samples can use the correct size.

How to Manage Kits

- Store specimen collection kits in a dry, cool place
- Store specimen collection kit where it will be accessible after hours and on weekends

13

The items in the specimen collection kit should be kept together, except for collection vials containing VTM, which should be stored in the freezer. As much as possible, the specimen collection kit should be kept in a dry, cool place. In addition, it must be accessible after hours and on weekends, in case you need to leave for the field at these times.

How to Safely And Correctly Collect Samples

14

We have completed the section on the specimen collection kit. Now we will move on to how to safely and correctly *collect* samples.

Clinical Specimen Collection Responsibility

- Usually a hospital staff function
- May be a rapid responder function if hospital staff are unavailable
- Designate at least one member of the team to be trained to collect specimens

15

Hospital staff will often perform clinical specimen collection. However, a rapid responder might need to collect a specimen if hospital staff are unavailable. So at least one member of the rapid response team should be able to collect specimens. Be sure that this responsibility is clearly designated.

Clinical Specimen Sources

Be prepared to collect specimens before
you leave for the field

- Suspected cases
 - Symptoms consistent with influenza
- Contacts
 - Including people living or working with suspected cases

16

You should plan on the need to collect specimens before you leave for the field, so that you are prepared when you arrive. Prepare the needed materials beforehand.

Specimen samples need to be collected from both suspected cases and their contacts. Suspected cases are people with symptoms consistent with an influenza illness. Contacts are people with direct contact with suspected cases, such as people who live or work with them.

What to Collect

Preferred specimens

- Oropharyngeal swab
- Lower respiratory tract specimens
 - Bronchoalveolar lavage or tracheal aspirates

Other specimens

- Nasal swab
- Nasopharyngeal swabs

Collect the sample on several different days

17

You can collect several clinical specimens to determine whether an illness is caused by avian influenza. You can use respiratory specimens or serological samples. It is best to collect both, if possible.

Oropharyngeal swabs and lower respiratory tract specimens (e.g., bronchoalveolar lavage or tracheal aspirates) are preferred because they may have the highest yield for influenza H5N1 detection, as determined on the basis of available data. However, lower respiratory specimens are difficult to collect when the patient is not intubated. Nasal or nasopharyngeal swabs and nasal aspirates are acceptable but may have lower yield. We will discuss how to collect oropharyngeal, nasopharyngeal, and nasal aspirate samples later in this presentation. You should collect as many types of specimens as possible.

If you collect serological samples, both acute serum and convalescent serum should be collected.

It is important that the samples are collected more than once. Collect samples on several days throughout the investigation of the patient.

When to Collect Respiratory Specimens

- As soon as possible after symptoms begin
- Before antiviral medications are administered
- Even if symptoms began more than one week ago
- Collect multiple specimens on multiple days

18

Influenza virus is most likely to be detected soon after symptoms begin. Therefore, in order to increase the chances that the laboratory can detect the H5 virus, respiratory samples should be collected as soon as possible after symptoms begin and before antiviral medications are administered. However, it is not always logistically possible to collect respiratory samples early in the clinical course of disease. But you can still collect specimens even if the symptoms began more than a week ago, as it is still possible to detect virus in these specimens.

It is best to collect multiple types of specimens on multiple days.

Serological Samples

Paired serum samples are most useful

Acute sample

Within 7 days after symptom onset

Convalescent sample

More than 21 days after symptom onset

19

Paired serum samples are more useful than serum just collected once. This is because the concentration of antibodies specific to avian influenza is hard to interpret on its own. However, when the antibody titer increases during an influenza-like illness, this is strong evidence that the illness is being caused by avian influenza. Therefore, you should take two samples if at all possible. The first sample, which is the acute sample, should be collected within 7 days of the onset of clinical symptoms. The second sample, which is the convalescent sample, should be collected more than 21 days after the onset of clinical symptoms.

Personal Protective Equipment

- Masks (N-95 or N/P/R-100)
- Gloves
- Protective eyewear (goggles)
- Hair covers
- Boot or shoe covers
- Protective clothing (gown or apron)

20

Regardless of the type of specimen that you collect—either respiratory or serological—when you collect clinical specimens from people who might have avian influenza, it will be important to follow safety precautions. Be sure that you wear personal protective equipment such as N-95 respirators or N/P/R-100 face masks, gloves, and protective eyewear. You should also wear hair covers, boot or shoe covers, and protective clothing such as gowns or aprons. You will learn more about personal protective equipment in the next module.

How to Collect Specimens

21

Now we will review the serological and respiratory sample collection process in detail with illustrations. We will follow each lecture segment with a demonstration. Then, at the end of this session, you will have an opportunity to practice each skill.

Field Data Collection Form

- Patient name
- Unique identification number
- Patient demographic information
- Patient's health status

22

When you meet with patients, you will need to collect information as well as specimens. This means that you will need to complete a “field data collection form”. On this form, you will record the patient’s name, a unique identification number, information about the patient’s health status, and demographic information. This information can be very useful when you conduct an epidemiological investigation of the source of the infection. The information can also help you identify potential contacts. In addition, you will record the name and identification number on any clinical specimens collected.

Field Data Collection Form

General patient information		Tracking record number	
Name	Sex (M/F)	Date of birth (mm/dd/yyyy)	
Address	Country	Nationality	
City/town/village	Occupation		

Date of onset of illness (mm/dd/yyyy) _____

Clinical specimens					
Unique ID No.	Type	Date of collection	Clinical diagnosis	Health status when specimen collected	Remarks

Pooled specimen specimens
(Date of collection) (mm/dd/yyyy) _____

Name of person completing form _____
 Institution or address _____
 Contact details (mm/dd/yyyy) _____

23

Here is an example of a field data collection form. The particular collection form used in your jurisdiction might be different. The tracking number in the upper right hand corner should be the same number as on the clinical samples taken from the patient. You may want to include priority ratings of the specimens to help the laboratory determine which specimens to test first.

The top portion of the form collects demographic information: the patient’s name, address, date of birth, sex, and occupation. Information about the health status and clinical diagnoses is also collected. Finally, it is important to provide information about how the specimen was collected. You should include a copy of the field data collection form with the specimens that you transport to the laboratory.

Specimen Tracking System

Maintain a database to track:

- Identification number
- Subject information
- Specimen collection date
- Specimen collection location
- Diagnostic test results

24

You will need to use a specimen tracking system to keep track of the specimens at all times. The particular specimen tracking system will vary by state. However, here are some guidelines. It is advisable to maintain a database that contains information about each sample, including the identification or tracking number, subject information, and when and where a sample was collected. Results from diagnostic testing should also be entered into the database.

Nasopharyngeal Swab

1. Insert dry swab into nostril and back to nasopharynx
2. Leave in place for a few seconds
3. Slowly remove swab while slightly rotating it



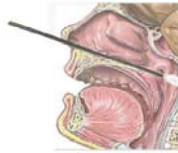
25

Now we will discuss how to collect specimens. First, we will describe how to collect a nasopharyngeal swab.

1. First, insert a dry drayon, rayon, or polyester swab into the nostril and back to the nasopharynx.
2. Leave the swab in place for a few seconds.
3. Then slowly remove the swab while slightly rotating it.

Nasopharyngeal Swab *continued*

4. Use a different swab for the other nostril
5. Put tip of swab into vial containing VTM, breaking applicator's stick

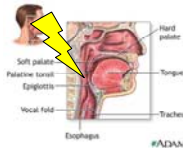


26

Use a different swab for the other nostril. Put the tip of the swab into a vial containing VTM, and break off the applicator's stick.

Oropharyngeal Swab

1. Ask the subject to open his or her mouth
2. Depress the tongue
3. Swab the posterior pharynx
4. Avoid the tonsils



27

Next, we will describe how to collect an oropharyngeal swab. You will swab the posterior pharynx, the area in the back of the throat behind the tonsils. Oropharyngeal swabs are preferred specimens.

1. First, ask the subject to open his or her mouth.
2. Next, depress the tongue using a tongue depressor.
3. Swab the posterior pharynx, avoiding the tonsils.

Nasopharyngeal Aspirate Collection Process

1. Attach mucus trap to vacuum source
2. Place catheter into nostril parallel to palate
3. Apply vacuum
4. Slowly remove catheter while slightly rotating it
5. Repeat with other nostril using the same catheter
6. After collection, flush catheter with 3 ml VTM and return VTM to a plastic vial

28

Now, we will describe how to collect a nasopharyngeal aspirate.

1. The first step is to attach the mucus trap to a vacuum source.
2. Next, place the catheter into nostril parallel to the palate.
3. Apply vacuum, and slowly remove the catheter while slightly rotating it.
4. Repeat the process with other nostril, using the same catheter.
5. After specimen collection, flush the catheter with 3 milliliters of VTM and return the VTM to a plastic vial.

How to Collect Blood

1. Put tourniquet on subject



Photos: CDC/ Jim Gathany

29

Now we will describe how to collect blood. In the United States, there are phlebotomy standards that must be followed for venous blood draws. Having a trained person who is competent at drawing blood will help avoid lawsuits.

First, identify potential sites to take blood on the subject. The site will usually be on the forearm below the elbow. Put the tourniquet on the subject above the site where blood will be taken.

How to Collect Blood

2. Clean area with iodine and alcohol



30

Then, clean the blood draw site with iodine and alcohol swabs.

How to Collect Blood

3. Attach assemble needle, needle holder, and collection tube



31

Next, attach the assemble needle, the needle holder, and the collection tube. Once everything is in place, remove the cap from the needle.

How to Collect Blood

4. Insert needle into vein

Collect at least 2 ml blood



32

Then, insert the needle into the vein. The collection tube should start filling with blood. Collect at least 2 ml of blood.

How to Collect Blood

5. Remove needle and apply pressure



33

Next, remove the needle and use a gauze pad to apply pressure to the site where the needle was inserted.

How to Collect Blood

6. Dispose of needle in biohazard sharps container

Do not reuse a needle



34

Finally, you will need to dispose of the needle in a biohazard sharps container. Do not reuse a needle.

Patient Care

- After blood draw, apply light pressure
- After removing gauze, put on a sterile Band-Aid



35

With a gauze pad still in place atop the venipuncture site, apply light pressure in order to absorb any bleeding that occurs after removal of the needle from the vein.

Immediately after removing the absorbent gauze pad, place a sterile, protective Band-Aid on the blood draw site in order to maintain a clean, dry environment. The Band-Aid will also act to absorb any additional fluids that may come from the puncture site.

How to Label Samples

Use pre-printed barcode labels:

- On the specimen container
- On the field data collection form
- On the log book

Label each specimen with:

- Subject's name
- Subject's unique identification number



36

It is very important to properly label the serological samples that you collect. Usually, labeling is done before the sample is collected.

Preprinted, barcoded labels printed with indelible ink on suitable label stock, such as “Tough Tags”, are ideal for labeling specimens, but might not be practical or available in all settings.

You will need to print a total of three copies of each bar-coded label: one label will be placed on the specimen container, one label will be placed on the standardized form, and one label will be placed in the log book. The log book is where records of all procedures are kept, and should note that a specimen was collected from a particular patient, and that the specimen was given a particular code. It will may be useful to print additional copies of the bar-coded label for other documentation your team or the laboratory may require.

If bar codes are not used, each serological specimen should be labeled with the name of the subject and a unique identification number. This number should also be included on the field data collection form, because a written label on a specimen may be accidentally smeared during handling.

Specimen Storage, Handling, and Transportation

37

We are next going to discuss considerations for storing, handling, and transporting the specimens that you collect. This may be the most important task related to specimens that you as a rapid responder will perform.

How to Store Specimens

For specimens in VTM:

- Transport to laboratory as soon as possible
- Store specimens at 4 °C before and during transportation within 48 hours
- Store specimens at -70 °C beyond 48 hours
- Do not store in standard freezer – keep on ice or in refrigerator
- Avoid freeze-thaw cycles
 - Better to keep on ice for a week than to have repeat freeze and thaw

38

Although you should send specimens in Viral Transport Medium (VTM) to the laboratory as soon as possible, it is important to properly store them before you send them to a laboratory. If you will be transporting specimens within 48 hours, you can store them at 4 °C both before *and* during transportation. If you will not be able to transport the specimens to the laboratory within 2 days, you need to store them at -70 °C. If this can't be done, keep the specimens on ice or in the refrigerator as long as necessary. DO NOT put specimens in a standard freezer, as this will damage them.

It is also very important to avoid freeze-thaw cycles. Do not freeze samples if they will thaw and be frozen again, as this will destroy the virus. It is better to keep a sample on ice even for a week, than to allow the sample to freeze and thaw multiple times.

How to Store Specimens

For sera:

- Store specimen at 4 °C
- For both VTM specimens and sera, avoid repeated freeze-thaw cycles

39

Storage conditions for sera (which is derived from the blood sample) are slightly different. Sera can be stored at 4 °C. For both VTM specimens and sera, avoid repeated freeze-thaw cycles.

Handling Infectious Materials in the Field

- Always wear personal protective equipment
- Be careful with sharp objects
- Treat all clinical samples as potentially infected with avian influenza

40

When collecting and handling infectious material in the field for processing or when preparing it for transportation, always wear personal protective equipment. This includes gloves, a mask, and protective clothing. Be very careful with needles and other sharp objects, as these items increase the chance of infecting someone. Finally, treat all clinical samples as though they are potentially infected with avian influenza.

Packing Specimens for Transportation

- Use three packaging layers
- First layer should be water tight
- Use absorbent material in all layers
- No more than 500 mL should be in the specimen container

41

When you are ready to pack specimens for transportation from the field to the laboratory, you must use three packaging layers. This is done to protect specimens from damage during transportation. The first packaging layer should be water tight, and all layers should be absorbent in case there are any leaks. There should be no more than 500 mL of liquid in the specimen collection container.

Packing Specimens for Transportation

- Keep specimens at 4 °C
 - Fill a cooler with ice packs or coolant packs
 - Double-bag specimens if you use dry ice
- Include an itemized list of specimens with identification numbers and laboratory instructions

42

Just as it is important to keep specimens cold during storage, it is important to keep specimens cold during *transportation*. Try to keep specimens at 4 °C. A cooler filled with ice packs can be used for this purpose, but do not use dry ice unless the specimens are double-bagged and airtight; carbon dioxide from the dry ice can inactivate the virus.

In all specimen shipments, include an itemized list of specimens, with specimen identification numbers and instructions for the laboratory.

Transporting Specimens

- Initial testing at State Public Health Laboratory
- Call CDC Hotline before sending specimens for reference testing **770-488-7100**
- Send Priority Overnight
- Include inventory sheet and CDC case ID number
- Coordinate with the laboratory

43

When you send any specimens from potential cases of avian influenza from the field to a laboratory, we recommend that you follow WHO guidelines which have been outlined here for the safe transport of infectious substances and diagnostic specimens. In addition, you may need to follow local regulations on the transportation of infectious material.

Be sure to coordinate the shipment with the laboratory. Arrangements should be made so that the laboratory is prepared to receive the specimens when they arrive. The initial test will be conducted at your state Public Health Laboratory. Confirmatory testing for positives can then be conducted at CDC.

State and local health departments should call the CDC Emergency Response Hotline (770-488-7100) before sending specimens for influenza A reference testing. This number is available 24 hours a day, 7 days a week. Hotline staff will notify a member of the Influenza Division, who will contact the health department to answer questions and provide guidance. In some cases, the state health department may arrange for a clinical laboratory to send samples directly to CDC.

Specimens should be sent by Priority Overnight Shipping for receipt within 24 hours. Samples (such as fresh-frozen autopsy samples for RT-PCR or other clinical materials) may be frozen at -70 if the package cannot be shipped within a specified time (e.g., if the specimen is collected on a Friday but cannot be shipped until Monday).

When sending clinical specimens, include a specimen inventory sheet and the assigned CDC case ID number and note “Influenza surveillance” on all materials and specimens sent.

Include the CDC case ID number on all materials forwarded to CDC. Protocols for standard interstate shipment of etiologic agents should be followed (available at <http://www.cdc.gov/od/ohs/biosfty/shipregs.htm>).

Managing and Analyzing Laboratory Data

44

Once the specimens have been collected, packaged, transported to the appropriate laboratory, and tested, the test results will become available. So the next step is managing the information that the tests provide. In this final segment of the module, we will briefly talk about managing and analyzing laboratory data.

Data Management Rules

- Double check data entry accuracy
- Include unique identification numbers
- Keep subject names confidential
- Track testing dates and results
- Back up the database

45

First, we will go over some general data management rules.

- It is advisable to double check the accuracy of data entry into the database. You can do this by having two different people enter the specimen information, and then check for inconsistencies. Or, after one person has entered the data, go back and check for mistakes
- Also make sure that each data record includes a unique identification number
- Keep the names of subjects confidential
- You also need to keep track of each test done and the results of each test
- Finally, back up the database either by printing it out or saving it to a disk

Computer Software

- Epi-info (CDC)
 - Free, at <http://www.cdc.gov/epiinfo/>
- Microsoft Excel and Access
- Oracle
- MySQL
- Filemaker Pro

46

You can use several types of computer software to manage and analyze laboratory data. Epi-info (which can be acquired for free from the United States Centers for Disease Control) is one example of computer software used for database management. There are also several commercial options, including Microsoft Excel and Access, Oracle, MySQL, and Filemaker Pro.

Data Analysis Measures

Prevalence

The number of cases divided by the size of the population

Sensitivity

The number of cases identified by the test divided by the number of true positives which were identified by the gold standard technique

Specificity

The number of non-cases identified by the test divided by the number of true negatives that were identified by the gold standard technique

47

How you approach the analysis of your data will depend on the type of information that you have collected and the research questions being asked. Here are a few common measures used in the analysis of potential avian influenza outbreaks:

Prevalence is the number of cases divided by the size of the population.

Sensitivity is the number of cases identified by the test divided by the number of true positives which were identified by the gold standard technique. A highly sensitive test will identify most or all people who have the infection.

Specificity is the number of non-cases identified by the test divided by the number of true negatives that were identified by the gold standard technique. A highly specific test correctly identifies those who do NOT have the infection.

How to Present Results

Report:

- Time and place of the outbreak
- Prevalence of infection
- Clinical information about cases
- Epidemic curve

Share results with local health officials and the CDC

48

Once all data have been entered, it is important to report or summarize the data analysis results in a succinct manner. The report can then be used by others who need to be informed of the progress of the outbreak. You should include the following information in a report:

- The time and place of the outbreak
- The prevalence of infection
- Clinical information about the cases
- The epidemic curve. You will learn more about creating epidemic curves in a case study later in this training.

Once your report is complete, you should share your results with local health officials and the CDC. The CDC will share any pertinent results with the WHO Global Influenza Program.

Laboratory Diagnosis for Avian Influenza

Tests for respiratory samples:

- PCR-based techniques
- Virus isolation
- Immunofluorescence
- Rapid antigen detection

Blood used for:

- Measurement of specific antibodies (sera)
- Viral isolation (whole blood)
- PCR-based techniques (sera)

49

Avian influenza diagnostic tests differ by specimen type, laboratory expertise, and interpretation. We will discuss several of these tests and how to interpret their results.

Tests for respiratory samples include:

- PCR-based techniques
- virus isolation
- Immunofluorescence
- rapid antigen detection

Blood sera is used for the measurement of specific antibodies against the influenza virus. Whole blood might also be useful for viral isolation and sera for PCR-based techniques, but there is less evidence supporting the use of blood for these purposes. Therefore, we will only discuss the use of blood sera for measuring antibodies.

Virus Isolation

- Gold standard for detection of avian influenza
- Allows identification of virus and test for drug susceptibilities
- Technically difficult and requires BSL-3 laboratory with enhancements

50

Virus isolation – or detecting the actual virus in a clinical sample – is the gold standard for detection of avian influenza. It allows identification of the virus and testing for drug susceptibilities. However, it is technically difficult and requires a BSL3 laboratory environment with specific safety enhancements.

PCR-based Techniques

- Examples: nested reverse transcriptase polymerase chain reaction (RT-PCR) and real-time RT-PCR
- Sensitivity depends on the particular test, the influenza strain, and the type of specimen used
 - Sensitivity: 80 - 100%
 - Specificity: 90 - 100%

51

Another way to test for avian influenza is the use of PCR techniques. There are actually multiple PCR techniques that can be used. These include techniques called nested reverse transcriptase polymerase chain reaction (RT-PCR) and real-time RT-PCR. Each test determines whether a specific virus is present in the sample. For example, in a group A test, it will determine if an influenza A virus is present. In an H5 test, it will determine if an H5 virus is present.

Test sensitivity depends on the particular test, the influenza strain, and the type of specimen used. When compared to the gold standard of viral culture, the PCR techniques have a sensitivity of 80 - 100% and a specificity of 90 - 100%.

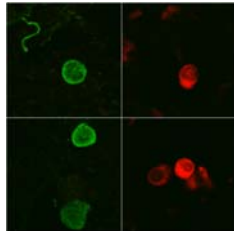
Immunofluorescence

- Works best on clinical specimens collected immediately after symptoms begin
- Results will tell you whether a particular influenza virus is present
- Sensitivity and specificity not established

52

Immunofluorescence is another method used to test a clinical sample for avian influenza. These tests are only performed at the CDC. Immunofluorescence works best on clinical specimens collected immediately after symptoms begin. The test results will tell you whether a particular influenza virus is present, but neither the sensitivity nor the specificity of this test have been established. This method does not provide for rapid diagnosis.

Indirect IF Staining of Cells From Tracheal Aspirate



Taken from: World Bank Training by Alexander Klimov, CDC

53

Here is an example of immunofluorescence being used to detect the presence of influenza viruses in clinical samples. In the upper left hand corner, an anti-H5 antibody was used. The green in this picture indicates that an H5 virus has infected the cell. In the upper right hand corner, a different sample was exposed to an anti-H3 antibody. The red cell indicates the presence of an H3 virus. You can also use immunofluorescence to determine whether the virus is in the influenza A or B group.

Rapid Antigen Tests

- Detects influenza A and B virus
- Detects human strains of influenza
- Limitations:
 - Not yet used to test for *avian* influenza
 - Specificity and sensitivity not yet established

54

Rapid antigen tests offer yet another testing approach in the laboratory. These tests can take less than 30 minutes to perform and are technically simple. There are several commercially available tests to detect influenza A and B virus. The tests are also useful in detecting human strains of influenza. However, these tests have *not* been tested on avian influenza.

Rapid antigen tests have many limitations to accurately detect H5N1, so a positive test results does not imply H5N1 is present. Nor does a negative test result imply that H5N1 is absent. Furthermore, the specific degree of sensitivity and specificity to detect avian influenza has not been established, so the results of these tests should be interpreted very cautiously.

Serology Tests

- Used to confirm infection because it takes several weeks to get results
- Useful when the sample is taken too late for virus isolation
- Sensitivity and specificity of 80 - 100%

55

Next we will talk about the serology tests. These are tests that are performed with the blood sera. Serology tests are used as confirmation of infection because it takes several weeks to get results. They are most useful when the sample is taken too late for virus isolation. When compared to the gold standard of viral culture, the serology tests have a sensitivity and specificity of 80 - 100%.

Serology Tests

Types:

- Haemagglutination inhibition test
- Enzyme immunoassay
- Virus neutralization test
- Western Blot

56

There are different types of serological tests that the laboratory might use to test serum specimens that you submit. Examples of serological tests include:

- the Haemagglutination inhibition test
- enzyme immunoassay
- the virus neutralization test
- the Western Blot

Serological Tests

Paired serum samples are most useful

Acute sample

Within 7 days after symptom onset

Convalescent sample

More than 12 days after symptom onset

57

Paired serum samples are more useful than serum just collected once. This is because the concentration of antibodies specific to avian influenza is hard to interpret on its own. However, when the antibody titer increases during an influenza-like illness, this is strong evidence that the illness is being caused by avian influenza. Therefore, you should take two samples if at all possible. The first sample, which is the acute sample, should be collected within 7 days of the onset of clinical symptoms. The second sample, which is the convalescent sample, should be collected more than 12 days after the onset of clinical symptoms.

When Single Samples are Appropriate

1. Convalescent samples collected in outbreak investigations of novel viruses (such as H7 or H9)
2. Single samples collected in convalescent phase are compared to age-matched controls

58

There are two situations in which single serum samples can be helpful in the diagnosis of influenza.

- The first is when convalescent samples are collected in investigations of outbreaks due to novel viruses (such as H7 or H9).
- The second is when single samples are collected in the convalescent phase and are compared to age-matched controls.

However, both of these exceptions are not ideal. It is still advisable to take *paired* samples.

Interpreting Serology Tests

Acute Sample	Convalescent Sample	Interpretation
low	low	No evidence of Infection
low	high	Seroconversion (evidence of infection)
high	high	Inconclusive; past exposure to avian influenza possible

59

Let's now look at how to interpret the paired serology tests.

When both the acute and convalescent samples have low levels of antibodies specific to avian influenza, then there is no evidence of infection.

When the acute sample has low levels of antibodies and the convalescent sample has high levels of antibodies specific to avian influenza, this is called seroconversion. It provides strong evidence of infection by avian influenza.

When the antibody levels in both the acute and convalescent sample are high and similar to each other, the test is inconclusive. Past exposure to avian influenza is possible. However, it is unlikely that the current infection is caused by avian influenza.

How to Avoid Misinterpretations

- Use positive and negative controls
- Make sure you understand what the test is identifying
- Use multiple tests to confirm results

60

Despite the fact that we have provided a quick summary of how to interpret results, you may certainly run the risk of *misinterpreting* test results. So this slide presents several measures that you can take to try to avoid misinterpreting test results.

- First, all tests should have positive and negative controls. Make sure that the controls make sense before the results of the samples are considered.
- Second, make sure you understand what the test is identifying. For example, a positive result from a PCR test for influenza A virus means that an influenza A virus is present. Therefore, avian influenza is possible but the disease could *also* be caused by a human strain of influenza A.
- Finally, you may choose to use multiple tests as a means of confirming results.

Summary

- Maintain adequately stocked specimen collection kits and store them properly when they are not in use.
- Oropharyngeal swabs and lower respiratory specimens have the highest yield
- Collect multiple specimens (respiratory and blood) on multiple days.

61

To summarize this lecture:

- Maintain adequately stocked specimen collection kits and store them properly when they are not in use
- Oropharyngeal swabs and lower respiratory samples have the highest yield
- Collect multiple specimens (respiratory and blood) on multiple days

Summary

- Proper specimen storage, handling, and shipping is vital to a successful laboratory test.
- Keep track of information on the specimens collected in a database or logbook.
- When handling infectious materials in the laboratory or in the field, take safety precautions.
- Properly dispose of any infectious material.

62

- Proper specimen storage, handling, and shipping is vital to keep the virus intact for a successful laboratory test
- Keep track of information on the specimens collected in a database or logbook
- When handling infectious materials in the laboratory or in the field, take safety precautions
- Properly dispose of any infectious material whether in the lab or in the field. Incineration is the preferred method for most materials.

Summary

- Most states will be able to perform influenza identification tests on a clinical specimen, but more specific testing may need to be done at a higher level national or regional laboratory.
- When you report on the progress of an outbreak investigation, share investigation results with local health officials and the CDC.

63

In summary, most states will be able to perform some basic influenza identification tests on a clinical specimen, but more specific testing may need to be done at a higher level national or regional laboratory.

When you report on the progress of an outbreak investigation, share investigation results with local health officials and CDC.

Laboratory Practice Exercise

64

This concludes the lecture for the laboratory module. Next we will have demonstrations of laboratory techniques and exercises for you to apply what you have learned.

Glossary

Centrifuge

A machine that uses high-speed rotation to separate materials with different densities.

Culture

The growing of microorganisms in a nutrient-rich medium.

Nucleic acid

A component genetic material such as DNA or RNA found in all cells in humans, animals, bacteria, and viruses. Every species and organism has a unique pattern.

65

Glossary

Pipette

A glass or plastic tube used to measure or transfer small amounts of liquid.

Saline

A liquid solution made of salt and water.

Viral Transport Medium (VTM)

The preservative liquid in which specimens are stored until they are tested.

66

References and Resources

- Recommended laboratory tests to identify avian influenza A virus in specimens from humans. World Health Organization, June, 2005.
http://www.who.int/csr/disease/avian_influenza/guidelines/avian_labtests2.pdf
- WHO guidelines for the collection of human specimens for laboratory diagnosis of avian influenza infection, 12 January 2005.
http://www.who.int/csr/disease/avian_influenza/guidelines/humanspecimens/en/index.html

67

Case Study

Case Investigation of Suspected Human Infection with Avian Influenza A (H5N1) Virus

Exercises

Case Study

Case Investigation of Suspected Human Infection with Avian Influenza A (H5N1) Virus

Overall Instructions

- In this exercise, group members will collectively act as a specialized Public Health Rapid Response Team (RRT) that has been assigned to investigate possible human illness associated with an outbreak of highly pathogenic avian influenza A (H5N1) among poultry.
- Depending on the size of the overall group being trained, it may be appropriate to break into smaller groups to complete this case study. This training has been designed for training breakout groups consisting of ≤ 10 persons, with facilitators assigned to each group.
- The scenario explores an outbreak of H5N1 in poultry that leads to human infection with H5N1 virus.
- Facilitators should adapt the scenario, as needed, to their local situation in order to improve the realism of the exercise and more effectively engage students.

Resources

Some useful documents for reference during this exercise or to examine when released include:

- WHO guidelines for investigation of human cases of avian influenza A (H5N1) – forthcoming
- CDC Guidance for State and Local Health Departments for Conducting Investigations of Human Illness Associated with Domestic Highly Pathogenic Avian Influenza Outbreaks in Animals – forthcoming
- USDA Summary of the National Highly Pathogenic Avian Influenza Response Plan, updated August 2006.

<u>Section</u>	<u>Title</u>	<u>Time Allot ted</u>
<u>A</u>	<u>Preparation</u>	<u>20</u> <u>min</u>
<u>B</u>	<u>Possible Poultry Outbreak</u>	<u>25</u> <u>min</u>
<u>C</u>	<u>Planning Response – Logistics</u>	<u>15</u> <u>min</u>
<u>D</u>	<u>Planning Response – Communications</u>	<u>25</u> <u>min</u>
<u>E</u>	<u>Initial Response</u>	<u>15</u> <u>min</u>
<u>F</u>	<u>Investigation – Interviewing</u>	<u>20</u> <u>min</u>
<u>G</u>	<u>Investigation – Quarantine, Antivirals, Vaccine</u>	<u>20</u> <u>min</u>
<u>H</u>	<u>Investigation – Active Surveillance</u>	<u>15</u> <u>min</u>
<u>I</u>	<u>Investigation – Case Classification & Communication</u>	<u>15</u> <u>min</u>
<u>J</u>	<u>Investigation – Case Interviewing</u>	<u>10</u> <u>min</u>
<u>K</u>	<u>Investigation – Case Management &</u>	<u>10</u>

	<u>Communication</u>	<u>min</u>
<u>L</u>	<u>Investigation – Infection Control</u>	<u>20</u>
		<u>min</u>
<u>M</u>	<u>Investigation – Case Classification & Line Listing</u>	<u>25</u>
		<u>min</u>
<u>N</u>	<u>Investigation – Specimen Collection</u>	<u>15</u>
		<u>min</u>
<u>O</u>	<u>Investigation – Assessing Human-to-Human Transmission</u>	<u>20</u>
		<u>min</u>
<u>P*</u>	<u>Investigation – Daily Report</u>	<u>20</u>
		<u>min</u>
<u>Q*</u>	<u>Investigation – Epi Curve</u>	<u>30</u>
		<u>min</u>
<u>R</u>	<u>Investigation – Mass Prophylaxis</u>	<u>15</u>
		<u>min</u>
<u>S</u>	<u>Investigation – Risk Communication</u>	<u>15</u>
		<u>min</u>
<u>T</u>	<u>Conclusion</u>	<u>5</u>
		<u>min</u>
<u>U</u>	<u>Evaluation</u>	<u>25</u>
		<u>min</u>

* These sessions may be omitted if group work is behind schedule.

A. Preparation

Instructions:

Read the following background information. In your small group, discuss the question that follows.

Time Allotted: 20 minutes

Background

It is Wednesday, November 14, 2007, and you are busy with the day-to-day work of the health department in your state. Among other activities, your health department has conducted two seasonal influenza vaccination clinics during this month, and another is scheduled for early December. The vaccine supply for seasonal influenza is expected to exceed demand this year.

You haven't been thinking much about avian influenza lately, although you know that the World Health Organization has classified the current Pandemic Alert Period situation as Phase 4, resulting from several clusters of limited human-to-human transmission of H5N1 virus in Asia and Europe. Just a couple of days ago, you heard that the Thai government conducted a mass poultry culling operation in an effort to decrease human infection there. To date no avian or human cases of highly pathogenic H5N1 have occurred in North or South America, although other avian influenza A viruses are circulating among poultry and wild birds.

Question 1 – With the worldwide Pandemic Alert Period situation classified as Phase 4 (increased, but still limited human-to-human transmission), what influenza surveillance activities are currently happening in your state for each of the following groups? Discuss routine seasonal influenza surveillance and enhanced H5N1 surveillance (if applicable).

- Poultry
- Wild Birds
- Humans

Suggested Answer –

Poultry: The USDA oversees poultry surveillance in three areas – 1) live bird markets, 2) commercial poultry flocks, and 3) backyard flocks (not testing, but encouragement of owners to enhance biosecurity on their farms). Commercial surveillance occurs through the National Poultry Improvement Plan (NPIP), and includes random testing of poultry flocks and monitoring of poultry production facilities. Participants should be encouraged to note state-specific surveillance activities, as they will differ significantly based on the state’s poultry population.

Wild Birds: The US Department of the Interior conducts wild bird surveillance in collaboration with USDA. The surveillance has five components – 1) investigation of morbidity and mortality in wild birds; 2) monitoring live, apparently healthy, wild birds, with an emphasis on those whose migratory patterns put them at higher risk- more testing occurs in Alaska than in any other state, because of significant mixing of Asian and North American birds that occurs there; 3) monitoring hunter-killed birds; 4) use of sentinel animals (either non-commercial backyard poultry flocks, or disease free ducks; and 5) environmental sampling of water and bird feces. Monitoring information is stored in the National HPAI Early Detection Data System (HEDDS).

Humans: Routine influenza surveillance in the U.S. has two primary components: virologic surveillance and disease-based surveillance. The national surveillance system includes the sentinel provider network (SPN), the 122 cities mortality reporting system, and the national notifiable disease surveillance system (NNDSS) for pediatric deaths, among other components. Participants may discuss how their state monitors data from these and other systems.

Enhanced surveillance for H5N1 during the Pandemic Alert Period (Phases 3-5) recommended in the HHS Pandemic Influenza Plan is:

“Testing for avian influenza A (H5N1) is indicated for hospitalized patients with

- *radiographically confirmed pneumonia, acute respiratory distress syndrome (ARDS), or other severe respiratory illness for which an alternative diagnosis has not been established, **and***
- *history of travel within 10 days of symptom onset to a country with documented avian influenza A infections in poultry and/or humans, **or***

Testing...should be considered on a case-by-case basis...for hospitalized or ambulatory patients with

- *documented temperature of greater than 100.4°F (>38°C), **and***
- *one or more of the following: cough, sore throat, shortness of breath, **and***
- *history of contact with poultry or a known or suspected human case of influenza A in an H5N1-affected country within 10 days prior to the onset of symptoms.”*

During Pandemic Alert Phase 4, health departments should follow the following revised guidelines for laboratory testing of suspected human cases of avian influenza A (H5N1) virus (CDC, 2006).

“Testing for avian influenza A (H5N1) virus infection is recommended for:

A patient who has an illness that:

- *requires hospitalization or is fatal; **and***
- *has or had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$); **and***
- *has radiographically confirmed pneumonia, acute respiratory distress syndrome (ARDS), or other severe respiratory illness for which an alternate diagnosis has not been established; **and***

has at least one of the following potential exposures within 10 days of symptom onset:

*A) History of travel to a country with influenza H5N1 documented in poultry, wild birds, and/or humans, **and** had at least one of the following potential exposures during travel:*

- *direct contact with (e.g., touching) sick or dead domestic poultry;*
- *direct contact with surfaces contaminated with poultry feces;*
- *consumption of raw or incompletely cooked poultry or poultry products;*
- *direct contact with sick or dead wild birds suspected or confirmed to have influenza H5N1;*
- *close contact (approach within 3 feet) of a person who was hospitalized or died due to a severe unexplained respiratory illness;*

B) Close contact (approach within 3 feet) of an ill patient who was confirmed or suspected to have H5N1;

C) Worked with live influenza H5N1 virus in a laboratory.

Testing for avian influenza A (H5N1) virus infection can be considered on a case-by-case basis, in consultation with local and state health departments, for:

*A patient with mild or atypical disease (hospitalized or ambulatory) who has one of the exposures listed above (criteria A, B, or C); **or***

- *A patient with severe or fatal respiratory disease whose epidemiological information is uncertain, unavailable, or otherwise suspicious but does not meet the criteria above (examples include: a returned traveler from an influenza H5N1-affected country whose exposures are unclear or suspicious, a person who had contact with sick or well-appearing poultry, etc.)”*

Participants may want to discuss how these guidelines are communicated to hospitals and other healthcare providers.

Nov	13	14	15	16	17	18	19	20
				Hen tests positive for H5N1				

B. Possible Poultry Outbreak: Part 1

Instructions:

Read the following scenario. As a group, brainstorm ideas to address the question that follows.

Time Allotted: 10 minutes

Update 1

On Friday, November 16th, around 10am, you receive a phone call from your state epidemiologist, who just spoke with the state veterinarian. The state vet received a call this morning from a USDA-approved veterinary laboratory participating in the National Animal Health Laboratory Network (NAHLN). The laboratory reported a positive H5 result from a real time reverse transcriptase polymerase chain reaction (RRT-PCR) test. The sample was from a hen brought to the laboratory by the owner of a small local farm after it was found dead late yesterday. Multiple samples from the bird are now being sent to the National Veterinary Services Laboratory (NVSL) in Ames, Iowa, to confirm the presence of H5. Your State Department of Agriculture will not make an official announcement of the positive H5 result until it is confirmed by a RRT-PCR test at NVSL. Results from NVSL's RRT-PCR test can be expected within 24 hours at the most. In addition to RRT-PCR testing, NVSL will conduct confirmatory tests including viral isolation, genetic sequencing, pathogenicity testing, and further analysis of viral isolates (results within 5-10 days). In the meantime, the state Department of Agriculture is sending a team to the scene to investigate and to take samples from the rest of the flock, at least half of which has died. The vet also mentioned that the farmer's daughter was home sick from school today. Your state epidemiologist asks you to call the state vet to gather additional information.

Question 1 – What questions would you ask the state vet during this phone call?

Suggested answer – Choose one group member to write questions on the flip chart. Some possible questions include the following:

Hen tests positive
for H5N1

1. *Information about the agriculture response*
 - a. *Is the State Dept of Agriculture implementing their AI plan?*
 - b. *What actions have been taken at the affected farm? Has the flock been isolated or culled?*
 - c. *Has the Dept of Agriculture implemented enhanced surveillance of other area farms?*
 - d. *How can the public health department best assist the department of agriculture at this stage?*
 - e. *Can public health send a response team to interview potential contacts?*
 - f. *Has the Dept of Agriculture team been trained on proper use of personal protective equipment (PPE)? Is all necessary equipment available to the team?*
 - g. *Has the Dept of Agriculture team received chemoprophylaxis with oseltamivir or another antiviral medication? Has the team received seasonal influenza vaccination? NOTE: Seasonal influenza vaccination does NOT protect against H5N1 infection, but rather is used to prevent the possibility of viral reassortment between H5N1 and human influenza strains.*
 - h. *Who else has been notified of the situation?*
2. *Info about the farm*
 - a. *Is there illness and/or death in the rest of the flock?*
 - b. *Size of flock and type of operation?*
 - c. *What is the name and contact information of the farmer?*
3. *Information about people*
 - a. *How many people had contact with poultry in the 7 days prior to signs and symptoms of illness in the birds? Get details about people and types of contact.*
 - b. *Has personal protective equipment been provided to the family, any farm workers, and responders? Is the PPE being used?*
 - c. *Who is responsible for monitoring responders for signs and symptoms of avian influenza?*
 - d. *Does anyone (including the daughter who stayed home from school) have flu-like symptoms?*

Hen tests positive
for H5N1

B. Possible Poultry Outbreak: Part 2

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 15 minutes

Update 2

From your conversation this morning with the state vet, you learned that the farm is a small, family-owned operation on 50 acres of land in the northeast part of the county. The owner, Rick Jackson, teaches at Springfield High School, and has the farm as a side business. He had about 80 free-range chickens prior to the outbreak.

Around 3pm, the state vet calls back to tell you that 53 of the 80 chickens on the farm have died since yesterday, and others have symptoms of illness, including hemorrhages under the skin. The flock has been placed under immediate quarantine, and will be euthanized later today. Although testing at NVSL to determine whether the strain is low- or highly-pathogenic will take 5-10 days, the state Department of Agriculture is proceeding as if the strain is highly-pathogenic due to the high mortality rate. USDA has sent representatives to collaborate with the state on the investigation. The area is near waterfowl habitat, so the vet will find out whether any wild birds have recently tested positive for H5N1, and notify the Department of Fisheries and Wildlife of the poultry outbreak.

When you ask about personal protective equipment (PPE), the vet says that the Dept of Agriculture has PPE, including fit-tested N-95 respirators, available for its response team already. However, the vet requests that you provide antiviral chemoprophylaxis to the team, since team members will be responsible for euthanizing and disposing of the flock. She asks that you also consider providing PPE and chemoprophylaxis to poultry workers throughout the area, since it is still unclear how the H5 virus entered the county.

Question 1 – Which agency is currently in charge? Consider whether any emergency operations plans are activated, and whether the incident command structure would be used at this stage.

Hen tests positive
for H5N1

Suggested answer – Answers may vary depending on local area, but it is likely that the state Department of Agriculture and/or the USDA are taking a lead role in the investigation at this stage. Participants should discuss the trigger points for activation of emergency plans and incident command structure (ICS). If ICS is activated, who is the lead incident commander? If it is not activated, who is in charge? What other agencies (in addition to Agriculture and Health) are involved at this point? Participants should be encouraged to discuss which aspects of the response are led by the Department of Agriculture, which (if any) by the Department of Public Health, and which (if any) by Emergency Management at this early stage. Another possible discussion point is whether any federal agencies would be involved in the response at this early stage. In states without well-developed avian influenza response plans, it is probable that the USDA would get involved. It would also be a good idea if someone or several people were tasked with the role of making sure that responders and workers are in compliance with wearing appropriate PPE and using it correctly.

Question 2 – In addition to routine animal and human surveillance activities, what types of active surveillance would be implemented in this setting?

Suggested answer – Although testing for pathogenicity takes 5-10 days, the positive H5 screening test, along with the mortality in the flock, means that the cases meet USDA's presumptive H5 highly pathogenic case definition (USDA National HPAI Response Plan, 2006). Specific actions in response to an outbreak of HPAI in animals include: active case/contact finding among the target population, hospital-based ILI and pneumonia surveillance, sentinel wild bird surveillance, or other methods including syndromic surveillance. The most important populations for surveillance and monitoring are people who have had, or will have, direct contact with poultry, including family members, any farm workers, and responders to the poultry outbreak. These people should undergo active daily surveillance for 10-14 days to assess illness. If the team administers inactivated seasonal influenza vaccine and/or antivirals to any contacts, they will also need to implement surveillance for adverse effects. Note: Issues surrounding seasonal influenza vaccination are covered elsewhere in this case study.

Question 3 – Do you plan to provide antiviral chemoprophylaxis to the Department of Agriculture response team? If so, where are the antivirals located? How do you access them? How will chemoprophylaxis be implemented?

Suggested answer – Yes, antiviral chemoprophylaxis with oseltamivir or another neuraminidase inhibitor should be provided to the response team. The team will

Hen tests positive
for H5N1

have close contact with sick or dead birds, and therefore will have a high risk for infection. Participants should be encouraged to discuss locations of antiviral stockpiles in their own states, the logistics for accessing the antivirals, and triggers for requesting resources from the Strategic National Stockpile (SNS). Considerations for implementation of chemoprophylaxis include: Will prescriptions be written? Will a full 10-14 day course of capsules be provided to contacts, or will directly observed therapy be conducted? How will you monitor compliance and adverse events? Finally, responders should be reminded that antiviral chemoprophylaxis is not a substitute for personal protective equipment. PPE must still be used appropriately.

Question 4 – Should you plan to provide antiviral chemoprophylaxis to other area poultry workers at this stage?

Suggested answer – *Since the primary objective is to prevent human infection and illness from H5N1 in poultry, the decision to provide antiviral chemoprophylaxis depends on the risk of having contact with infected poultry. If there is reason to believe that other poultry flocks may be infected with HPAI H5N1, it is probably prudent to administer chemoprophylaxis to other area poultry workers. It may also be worthwhile to discuss which agency (i.e. health department or other) has the responsibility for providing antiviral medication to poultry workers.*

Nov	13	14	15	16	17	18	19	20
				Hen tests positive for H5N1				

C. Planning Response - Logistics

Instructions:

You must plan how you will respond to this situation before you leave for the field. Read the following update, and as a group, answer the questions. Use an easel, pad of paper, or chalkboard to create the list requested in Question 2.

Time allotted: 15 minutes

Update 3

Because of the high mortality of the flock, and the preliminary positive H5 test, you decide to proceed as if the virus is highly pathogenic. After receiving permission from the state veterinarian to visit the farm, you call your public health rapid response team and prepare for an investigation. The team will be responsible for identifying contacts who may have been exposed to ill poultry, and monitoring those contacts for signs and symptoms of human infection with H5N1 viruses.

Question 1 – Who are the members of the public health rapid response team? Think about this in terms of roles that should be filled, and note which person will serve as the team lead.

Suggested answer – *Clinician, epidemiologist, laboratory technician (or someone to collect specimens), veterinarian. Other possible roles are administrator/operations manager, logistician, interviewers, environmental health specialist, communication specialist, and hospital representative. Team lead will vary by local area.*

Question 2 – What documentation, forms, and other resources does the team need to bring? Create a checklist of necessary paperwork and resources.

Suggested answer – *Although responses will vary, the following is a sample list of documents, forms, and resources that might be useful.*

Hen tests positive
for H5N1

SAMPLE CHECKLIST OF DOCUMENTS NEEDED FOR AVIAN INFLUENZA OUTBREAK INVESTIGATION

Documents and Forms

- ☐ Proof of health department employment – photo ID
- ☐ Field investigation guide
- ☐ Questionnaires – Cases
- ☐ Questionnaires – Contacts
- ☐ Questionnaires – Health care providers
- ☐ Letter from health officer to access medical records protected by HIPAA
- ☐ Line-listing form
- ☐ Data collection form for environmental/home investigation
- ☐ Sample Collection Form – Clinical
- ☐ Sample Collection Form – Animal
- ☐ Sample Collection Form – Environmental
- ☐ Educational and informational materials for public
- ☐ Contact information – local and state phone numbers, Nextel numbers and emails
- ☐ State reportable disease card?

Resources

- ☐ Laptop computer w/ flash drive or cds, data management software
- ☐ Antiviral medication
- ☐ Inactivated seasonal influenza vaccine and coolers to store it
- ☐ Personal protective equipment (goggles, fit-tested respirators, gowns, gloves)
- ☐ Specimen collection materials, sterile viral transport media, blood drawing supplies
- ☐ Decontamination solution, alcohol-based hand gel
- ☐ Communications equipments (e.g. cell phones, radios)
- ☐ CDC guidelines on conducting an avian influenza investigation
- ☐ Basic summary of avian influenza in humans, including case definitions, reporting, and case management
- ☐ Contact information for team members, supervisors, Department of Agriculture representatives, and state veterinarian
- ☐ Educational information (e.g. brochures about avian influenza and personal safety)
- ☐ Money
- ☐ Digital camera for documentation
- ☐ Cell phones
- ☐ Medical equipment (e.g. stethoscope) for clinicians
- ☐ Permanent marking pens

Hen tests positive
for H5N1

D. Planning Response - Communications

Instructions:

Read the following update. As a group, please brainstorm answers to the following questions and complete the table provided in your workbook.

Time allotted: 20 minutes

Update 4

You've now planned your initial response, and gathered documentation and supplies to make a visit to the farm. Before you leave, you need to develop a communications plan. It will be especially important to plan for communications between your health department and the Department of Agriculture, and to determine how your agencies will coordinate messages to the public.

Question 1 – What (if any) information do you need to communicate to each of the following individuals or organizations before you leave? Note that your State Epidemiologist or State Health Director will likely take responsibility for communicating with CDC and other federal agencies, and either the State Health Director or Public Information Officer will take primary responsibility for communicating with the public.

WHO to contact	Information to share
Your State Veterinarian	
Your State Department of Agriculture	
Your State Epidemiologist	
Your State (or local) Health Dept Public Information Officer	
Hospitals and healthcare facilities in affected area	
Diagnostic / Reference Laboratory	
Your Family	

Hen tests positive
for H5N1

Suggested answer – Choose one group member to record responses on a flip chart. Responses will vary, and the list below is not exhaustive. It assumes that the responders are local health department officials. Expected answers could be adjusted appropriately for state-level responders.

WHO to contact	Information to share
Your State Veterinarian	Explain Dept of Health procedures for investigation following HPAI outbreak. Request permission to visit site Get info on proper PPE to use onsite
Your State Department of Agriculture	Notify of farm site visit and public health human contact tracing activities
Your State Epidemiologist and State Health Department	Notify of farm site visit Discuss case and contact tracing
Your State (or local) Health Dept Public Information Officer	Apprise of the ongoing investigation and the agencies/departments involved
Hospitals and healthcare facilities in affected area	Alert to the possibility of HPAI on a farm and remind them of human signs and symptoms, reporting procedures
Diagnostic / Reference Laboratory	Warn that potential HPAI specimens from ill persons are likely to come in for diagnosis
Your Family	Teach them to watch for signs and symptoms of HPAI among each other, and how to prevent transmission

Question 2 – Which person (role) on the RRT is responsible for communicating with agencies, health care providers, and the media?

Suggested answer – This may vary depending on the local area. The RRT should be prepared to deal with the media immediately, in case they are already at Jackson Farm. It is possible that the RRT will not have direct contact with the media, but because they will be working in the field, it is likely that they will come into contact with health care providers and the general public. The RRT may want to designate one team member as the communications liaison.

Question 3 – Will there be communication/language/cultural barriers when you arrive in the field?

Hen tests positive
for H5N1

Suggested answer – *The RRT may want to find out ahead of time whether the farm owner and workers speak English. If not, the RRT should be prepared to provide translation or a bilingual interviewer. In addition, the RRT should provide reassurance that they are only investigating the potential human health aspects – not looking for potential worker violations, etc. The RRT should also provide reassurance about PPE and other strategies (e.g. handwashing) that the farmer can use to protect himself, workers, family, etc.*

Question 4– How will team members communicate with each other once they are in the field? Have all rapid response team members been trained on how to use necessary communication devices?

Suggested answer–

Depending on the situation at the site, some options for logistics may be:

- *The team will not be separated*

OR

- *All team members stay in communication with one person, updating them on their whereabouts and progress. This one person then can answer any questions about where team members are, what they are doing, and what progress has been made.*

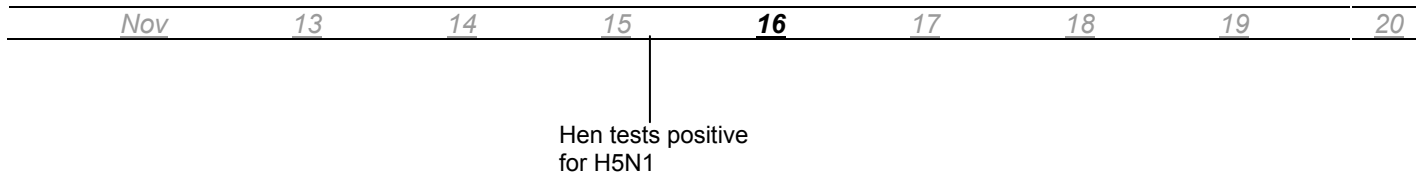
OR

- *The team meets at the same place at time every day, or twice a day, for a debriefing and writing/sharing the daily written report.*

Options for mechanics of communication:

- *2-way radios*
- *Cell phones*
- *Pagers*
- *Satellite phones (Nextels)*
- *Meet in person*

This is a good place for redundancy – having more than one system of communication is wise. Communication with local area authorities may be necessary to ensure that radios are operating on the correct frequency for the



area, and that your team's communications are not interfering with other local area emergency functions.

Question 5 – Should public health and agriculture agencies establish a Joint Information Center (JIC) at this time? Why or why not?

Suggested answer – *Answers to this question will vary by state. Participants should be encouraged to discuss triggers for opening a Joint Information Center and identify the persons at local and state public health and agriculture agencies who are responsible for deciding to open a Joint Information Center.*

Question 6 – What communication channels will be used to share information between public health officials at different levels of government (federal, state and local) or in different geographic areas?

Suggested answer – *Epi-X, Health Alert Network, personal emails and phone calls.*

Nov	13	14	15	16	17	18	19	20
-----	----	----	----	-----------	----	----	----	----

Hen tests positive for H5N1

E. Initial Response

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 15 minutes

Update 5

It is around 6pm on Friday the 16th, and your rapid response team (RRT) has arrived at the farm, which has been designated as an infected premise by the USDA. You manage to find the state veterinarian, who directs you toward the house, where the couple who owns the farm is waiting. The couple's two teenage daughters are both home – one of whom stayed home sick from school today. The state vet tells you that the couple also has a son in his early 20s who lives with his parents but isn't currently at home. It isn't clear whether any of these people have symptoms of highly pathogenic avian influenza (HPAI) H5.

Question 1 – What biosecurity issues do you need to consider when entering and exiting the farm?

Suggested answer – *The state Department of Agriculture or the USDA will have jurisdiction over biosecurity and biosafety procedures at the infected premises and in the surrounding area, so the public health team should follow instructions from those agencies. It is possible that the Dept of Ag will request that the RRT set up their operation outside of the infected premises. If the RRT is allowed onto the farm, team members will likely follow specific precautions including getting permission from the state veterinarian to enter the area, showering and changing clothing before leaving the farm, and thoroughly decontaminating and disinfecting any vehicles or equipment that were brought onto the premises. The key point is to avoid bringing any contaminated material off of the infected premises.*

Hen tests positive
for H5N1

Question 2 – Should your rapid response team use PPE when interviewing potential cases and contacts? If yes, what precaution level? If not, why is PPE not necessary in this situation?

Suggested answer – *There is not a clear answer to this question, without knowing whether any of the people have symptoms, or where the chickens were kept in relation to the house. Because the farm has been designated as an infected premise by the USDA, it is possible that the USDA or State Department of Agriculture will require all visitors to the farm to wear at least basic PPE. Encourage group members to discuss the pros and cons of using PPE in this situation, and acknowledge the balance between protecting the interviewers and not instilling fear. It is probably ok to conduct interviews without PPE, if observing basic infection control protocol and a minimum 3 foot distance between interviewer and interviewee. However, the RRT may want to have basic PPE (masks and gloves) available in case any interviewees are clearly symptomatic.*

Question 3 – The family has noticed that some first responders from the Department of Agriculture are wearing gloves and masks. They ask you whether they should be wearing gloves and masks too. How do you respond?

Suggested answer – *CDC has not yet issued guidance for PPE use in home and community settings, although such guidance is currently in preparation. Based on current information about the HPAI H5N1, the primary risk factor is close contact with poultry, so the family should be instructed not to have further contact with the poultry, but that PPE is probably not necessary. However, the family should be educated on proper respiratory and hand hygiene. If anyone in the family develops symptoms, the other family members should wear gloves and masks to minimize the small possibility of human-to-human transmission.*

Question 4 – What is the specific assignment of each team member in this situation? Complete the chart below.

<u>RRT Role</u>	<u>Task</u>
<u>Clinician</u>	
<u>Epidemiologist</u>	
<u>Laboratory Technician</u>	

Nov	13	14	15	16	17	18	19	20
				Hen tests positive for H5N1				

Infection Control Practitioner

**Other (logistician, veterinarian,
environmental health specialist,
etc)**

Suggested answer – Although responses will vary, at least one RRT member should be responsible for communicating with responders from other agencies (especially the Dept of Agriculture), and the incident commander, if applicable. It is important that agencies coordinate in order to avoid asking the family the same questions multiple times, and to share relevant information. Is there any chance that foul play has occurred? If so, how would you deal with law enforcement, especially as it relates to sharing information? The other RRT members will probably conduct initial screening interviews of the family. One member may want to be responsible for tracking down the couple's son so he can be interviewed.

Nov	13	14	15	16	17	18	19	20
-----	----	----	----	-----------	----	----	----	----

Hen tests positive
for H5N1

F. Investigation - Interviewing Possible Cases

Instructions:

Read the following update. In your small group, act out the role play that follows.

Time Allotted: 20 minutes

Update 6

You have decided that some of your team members will interview the farmer, Rick Jackson, and his wife and daughters. Meanwhile, another team member will act as a communications liaison to exchange information with other agencies, including the state Department of Agriculture. In addition, that person will try to contact and interview the older son.

Role Play Instructions – Split into groups of two. One person will be an interviewer from your rapid response team (RRT), and the other person will be Rick Jackson, the owner of Jackson farm. The RRT interviewer can use the form provided in Appendix A as an interview guide. The farmer should use the information on the following 2 pages to respond to questions. The RRT interviewer should NOT look at the information on the following 2 pages. Keep in mind that the farmer should answer only those questions posed by the interviewer.

Facilitator – *After the group has completed the role play, ensure that they have covered Rick Jackson's symptoms and the names of others who had contact with poultry.*

Hen tests positive
for H5N1

Info for farmer

Name: Rick Jackson

Age: 43 **Date of Birth:** August 22, 1963

Family: wife, Heidi, son, Trevor (22), and two daughters, Lisa (18) and Claire (15)

Job: High school teacher and football coach

Chronic illnesses: none, except high blood pressure since 1999

Medications: high blood pressure meds since 1999

Smoking: used to smoke regularly but quit 12 years ago

Allergies: None

Signs & Symptoms: You have been feeling fine – no fever, body aches, or eye irritation. You do have a slight cough that started today, but it isn't anything serious. You aren't concerned about yourself, but you are concerned about your family and your livelihood.

Seasonal influenza shot: no

Most recent doctor's visit: at least 2 years ago

Farm: You operate a small 50 acre farm, and raise chickens primarily for consumption. You inherited the farm 10 years ago when your grandfather passed away, and you enjoy spending time on the land. Every April you buy approximately 200 chickens, and you do not repopulate the flock throughout the year. You slaughter 10-15 each week and sell them at the local farmer's market, along with the eggs. Your family also uses the poultry products. Every December, you slaughter the remaining chickens and sell them to a local butcher. You had 80 chickens on your farm prior to the outbreak. Your chickens are free-range, and it's possible that they would have been in contact with droppings from wild birds or that wild birds may have shared their water source. You also grow vegetables and raise goats.

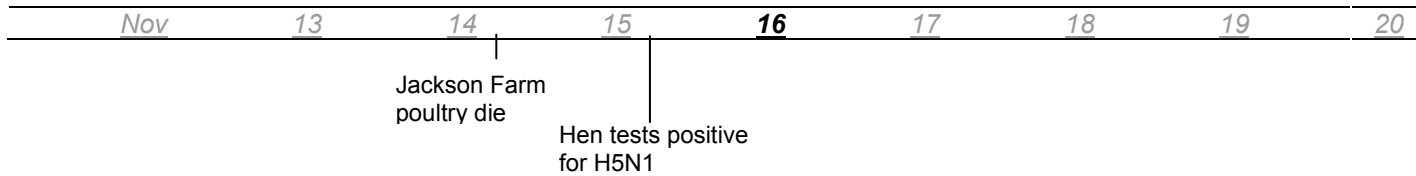
You don't have any employees, but your son Trevor and daughter Claire help out quite a bit on the farm. Your neighbor Bill Zalesky is retired, and he usually spends a couple of days each week helping out at the farm, in exchange for some chicken and eggs.

Hen tests positive
for H5N1

Contact with poultry: Several people, including you, your son Trevor, and your daughter Claire, have daily close contact with the poultry. Trevor feeds and waters the flock in the morning, and Claire does the same after school. Both gather eggs. Your wife Heidi and daughter Lisa have only occasional contact, although Heidi does prepare and cook chicken from the farm. Your neighbor Bill helps with poultry slaughtering almost every week.

Yesterday: When you woke up yesterday, you found 10 chickens dead. Others looked ill, with swollen heads and legs, nasal discharge, and lack of coordination. You were very concerned about avian influenza and Exotic Newcastle Disease. You wrapped one of the dead birds in a garbage bag and brought it to the closest veterinary laboratory, in your regular truck, the 1994 Ford F150. You and Trevor had the majority of contact with the sick and dead birds, and Bill Zalesky (neighbor) helped out for a short while. You washed your hands after caring for the birds, but you don't always wash your hands immediately after having contact with the chickens because you are often too busy. Lots of times you wear work gloves, though. Today you didn't have contact with the birds.

Other potential contacts: There are daily visitors to the farm, of one type or another, including friends of the family, and people picking up and dropping off supplies. You sell your chickens and eggs at the farmer's market on Saturday mornings.



G. Investigation - Quarantine, Antivirals, and Vaccine

Instructions:

Read the following update. In your small group, discuss the questions that follow.

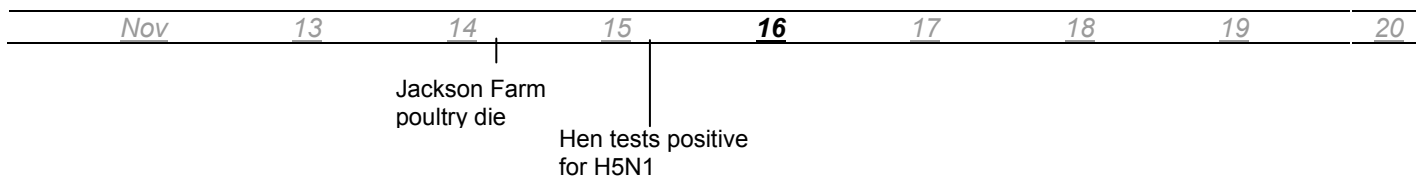
Time Allotted: 20 minutes

Update 7

You have now completed interviews with the Jackson family, with the exception of the son, Trevor, who hasn't yet responded to cell phone messages. You have also interviewed Bill Zalesky, a neighbor who helps out on the farm. Rick Jackson reports having a slight cough, and Claire has a sore throat and cough that began this morning, but no one else reports respiratory symptoms. None of them report diarrhea or eye irritation, and none have fever. Both Rick and Trevor had extensive contact with the sick poultry yesterday; Claire helped out for a short time yesterday, and also has routine daily poultry contact. Bill Zalesky, the neighbor, helped out yesterday, but does not report any signs or symptoms of illness. Before you leave the farm, you need to make some decisions about quarantine, specimen collection, and antiviral chemoprophylaxis.

Question 1 – Do you recommend that any or all of these people remain under voluntary quarantine? If so, for how long? As a reminder: quarantine is for people who have been exposed but are not yet ill, and isolation is separation of ill people from others.

Suggested answer –*There are two issues here: 1) to prevent movement of contaminated materials from the farm to other places, and 2) to limit opportunities for virus transmission between humans. The Department of Agriculture should provide clear guidelines about biosecurity (e.g. showering and changing clothes when leaving the farm). The Department of Public Health should provide guidance about contact with other people. At a minimum, the Jacksons and their neighbor Bill should be instructed not to visit any other farms or unaffected locations, to prevent the spread of the virus via contaminated material. Those people who had close contact with ill poultry (Rick, Trevor, Claire, and neighbor Bill Zalesky) should be asked to stay home and monitor*



symptoms for the next 10 days. They should be given clear instructions about how to report their signs and symptoms to the RRT (or other health dept staff), and when to seek medical care. The team may want to ask the rest of the family to put themselves under voluntary quarantine as well, since it is possible that they have been exposed to poultry and have yet to develop symptoms.

Question 2 – Do you administer post-exposure antiviral chemoprophylaxis to any or all of these people? If so, which drug should you use?

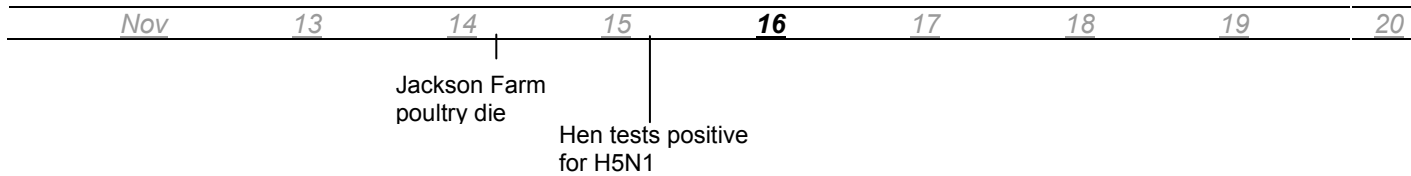
Suggested answer – *Yes, you should administer a neuraminidase inhibitor like oseltamivir (Tamiflu) or zanamivir (Relenza) to the entire Jackson family, as well as Bill Zalesky. However, it is probably best to collect specimens from Rick and Claire prior to beginning chemoprophylaxis, since they have respiratory symptoms.*

The neuraminidase inhibitors are effective against seasonal influenza viruses, but the degree of effectiveness against H5N1 remains unclear. Based on the available data, which are very limited, the World Health Organization does recommend oseltamivir chemoprophylaxis for high- and moderate-risk exposure groups, which include close contacts of suspected and confirmed human cases and ill poultry (Schunemann et al, 2007). Oseltamivir should be given as soon as possible after exposure status is known and continue for 7-10 after last known exposure.

Dosing schedule for oseltamivir chemoprophylaxis

<i>Patient Age</i>	<i>Prophylactic Dose</i>
<i>> 13 years</i>	<i>1 capsule (75 mg) once a day</i>
<i>1 to 12 years</i>	<i>< 15 kg: 30 mg once a day</i>
	<i>15-<23 kg: 45 mg once a day</i>
	<i>23-<40 kg: 60 mg once a day</i>
	<i>> 40 kg: 75 mg once a day</i>

Duration of chemoprophylaxis depends on the epidemiologic setting, but post-exposure use is typically for 7-10 days.



Even though Heidi and Lisa did not have contact with the poultry, it may be prudent to provide the antiviral to them, since they are close contacts of people who worked directly with the poultry. Check all for contraindications of pregnancy or breastfeeding, kidney or liver disease, before administering medications.

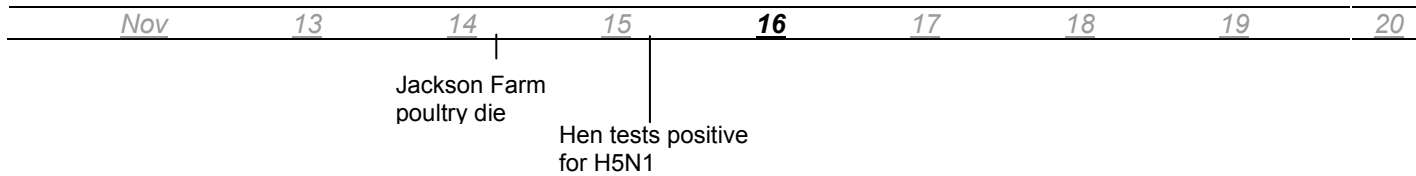
Note: Amantadine and rimantadine (drugs used for treatment of seasonal influenza) are NOT recommended for avian influenza, because H5N1 has been shown to be resistant to these drugs in some patients, and they are not as effective as the neuraminidase inhibitors.

Question 3 – Do you collect specimens from any or all of these people?

Suggested answer – CDC recommends that specimen collection be considered on a case-by-case basis for people with mild disease and known exposure to poultry infected with H5N1 (CDC, 2006). Based on this guidance, and the fact that you will start them on antiviral medication, you should probably collect specimens from Rick and Claire, the two family members with close poultry contact and possible disease symptoms. Specimen collection will be addressed in greater detail in Section N.

Question 4 – Do you administer inactivated seasonal influenza vaccine to any or all of these people? If yes, what is your rationale for using inactivated seasonal influenza vaccine?

Suggested answer – The RRT should probably administer inactivated seasonal influenza vaccine to all of them. Please emphasize that human influenza vaccine will provide NO protection against infection with the H5N1 virus. Rather, the goal is to reduce the chance of dual infection with human influenza A and HPAI H5N1 viruses to prevent the chance for viral reassortment. Participants may want to discuss how to effectively communicate this distinction to people receiving seasonal influenza vaccine, and to the general public. It is also important to note that it may take up to 2 weeks for the body to mount an immune response to the vaccine. However, because the RRT does not know about the possibility for ongoing exposure, it is best to provide the vaccine. Finally, note that live influenza virus vaccine should NOT be given to people exposed to H5N1 who may also be receiving antiviral chemoprophylaxis.



Question 5 – What is your plan for monitoring the Jacksons and Bill Zalesky for HPAI H5N1 signs and symptoms and adverse effects to inactivated seasonal influenza vaccine or antiviral medications?

Suggested answer – *Monitoring should focus on three areas: signs and symptoms of HPAI H5N1, adverse effects of seasonal influenza vaccine, and adverse effects of antiviral medications. At this point, since the number of contacts is manageable, the RRT should probably call all contacts on a daily basis to assess any signs and symptoms, with emphasis on those listed below. Contacts reporting the signs or symptoms below should be evaluated by a clinician.*

Signs and symptoms of HPAI H5N1 – fever, cough, shortness of breath, sore throat, diarrhea, muscle aches, headaches, abdominal pain, and vomiting.

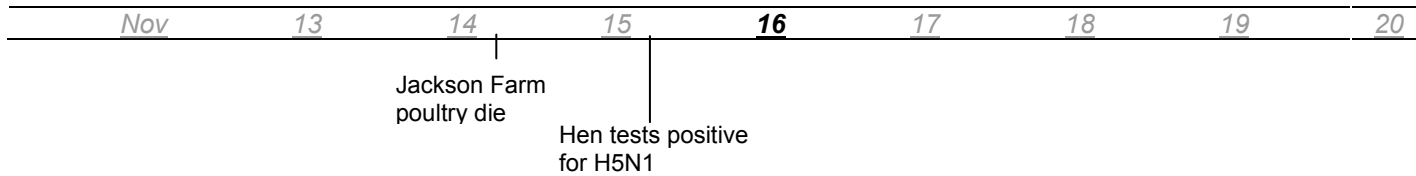
Adverse effects of seasonal influenza vaccine – Possible side effects include fever, rash, injection site reactions, muscle aches, general malaise, and seizures

Adverse effects of antiviral medications - Effects may include allergic reactions, skin rashes, facial swelling, and hepatitis. Less serious side effects include headache, nausea, vomiting, and fatigue. The most common and likely adverse effects of oseltamivir are gastrointestinal. However, the FDA recently added neurological symptoms as rare adverse effects to the packaging label for Tamiflu.

Question 6 – Are there other people who should receive antiviral chemoprophylaxis or seasonal influenza vaccine?

Suggested answer – *Yes. Anyone involved in the HPAI control and eradication activities should also receive antiviral chemoprophylaxis with oseltamivir or zanamivir and the inactivated seasonal influenza vaccine. As the contact investigation proceeds, there may be others who should also receive antiviral chemoprophylaxis, including people who may have been in contact with ill poultry and people in contact with suspected or confirmed human cases (e.g. coworkers, friends).*

Note: With respect to people involved in control and eradication activities, the best strategy would be to identify people in advance of an outbreak who would be involved in such activities and be sure that they receive seasonal influenza vaccine annually.



H. Investigation - Active Surveillance

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 15 minutes

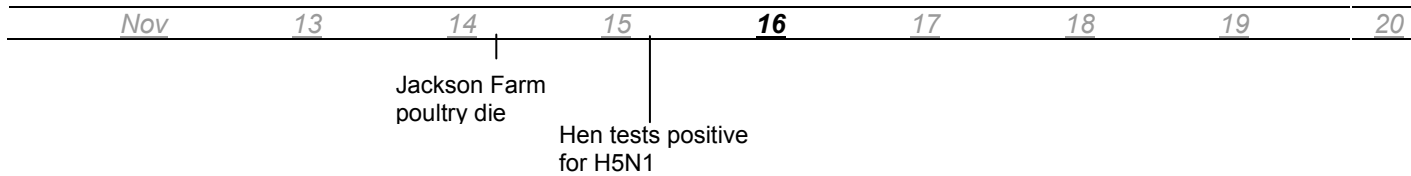
Update 8

It's now late in the evening. Before calling it a day, your rapid response team has a debriefing and planning meeting. You want to plan and prioritize activities for tomorrow. You know that active surveillance is going to be a key strategy to prevent and treat human cases of HPAI H5N1.

Question 1 – What specific surveillance strategies will you use to identify potential human cases and contacts?

Suggested answer –

- *Limit the case definition to specific situations, including specific exposures, symptoms, incubation period, and laboratory test results.*
- *Identify individuals and groups that had known or potential exposures in the 72 hours prior to the first signs of illness in poultry. Begin with people that had known contact with the ill poultry or may have been exposed to contaminated material such as manure or farm equipment, including farm visitors, Department of Agriculture response team members, other first responders, and veterinary and laboratory staff that handled the first dead bird.*
- *Work with Department of Agriculture to determine whether animals, supplies, or equipment were transported between Jackson Farm and other areas in the 72 hours before the poultry developed symptoms. Those areas could potentially be exposed, so human case-finding activities may be warranted there.*
- *Work with Department of Agriculture to identify the source of the virus, and identify contacts as investigation develops.*
- *Expand routine influenza-like illness surveillance by:*
 - a. *Providing area hospitals and other healthcare providers with case definition and risk assessment questions – this might occur through a HAN or other*



blanket message. Participants should discuss what case definition would be used at this early stage, prior to the identification of human cases.

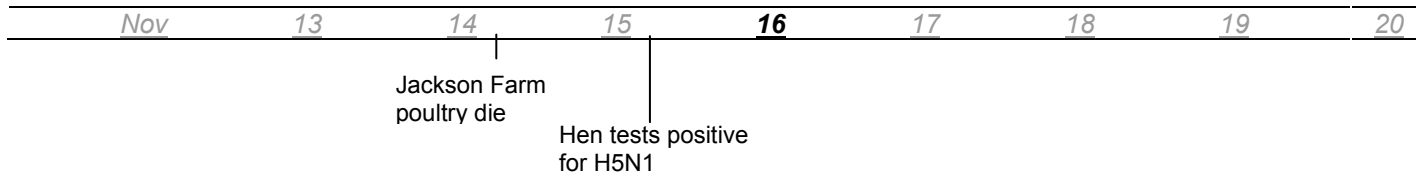
- b. Alerting area and state laboratories to consider H5 infection in patients with ILI and contact with sick or dead poultry or an ill person who had contact with sick or dead poultry.*
- c. Implementing enhanced hospital-based surveillance. This may include actively monitoring emergency room and admissions records for acute febrile respiratory illness. It may also involve active monitoring of healthcare workers for signs and symptoms of illness. Participants should discuss how to determine which hospitals should receive enhanced surveillance.*
- *Consider how to find people who have purchased poultry or eggs from Jackson Farm in 72 hours prior to the first symptom onset in poultry. Participants should discuss records or other methods (e.g. media messages) that might be used to find these people.*

Question 2 – Who do you need to follow-up with in the morning? Which possible cases or contacts are your highest priority?

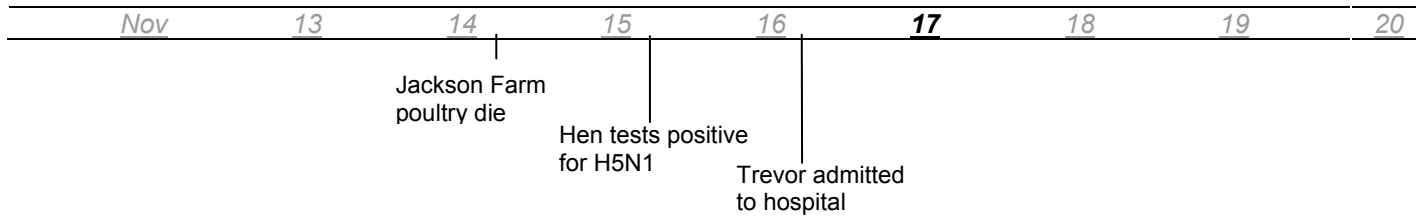
Suggested answer – *Rick Jackson's son, Trevor, is the highest priority because he had direct contact with the sick birds, and he has yet to respond to cell phone messages. Monitoring signs and symptoms in Rick and Claire Jackson, the rest of the Jackson family, and the neighbor, Bill Zalesky, is also a high priority because these people had known or possible contact with sick poultry. You will also want to follow-up with the state vet and other initial responders, including laboratory staff that handled the dead bird, to monitor them for signs and symptoms of illness, to assess compliance with proper use of PPE, and to ensure that they received antivirals and inactivated seasonal influenza vaccine. Finally, you should follow-up with anyone else who visited the farm over the past few days, people who purchased Jackson Farm chicken or eggs at the local grocery store and the farmer's market. At this point, people who had direct contact with the sick poultry are the highest priority, since there isn't yet an indication of possible human-to-human transmission.*

Question 3 – Who do you need to update about today's events?

Suggested answer – *Some people you may want to update are the State Health Director, State Epidemiologist, Local Health Director, Incident Commander (if such a structure has been activated), your own family, Commissioner of Dept of Agriculture, State Veterinarian, attending physician at hospital ER, other local healthcare providers, and the public. It may be best to work with a*



Communications Officer to disseminate information to some of these groups. The CDC will be involved in the investigation at some level, either directly onsite or through frequent briefings. Communication with the CDC will likely occur through the State Epidemiologist and/or State Health Director. Also, the CDC laboratory will likely be involved in testing human clinical specimens.



I. Investigation - Case Classification

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 15 minutes

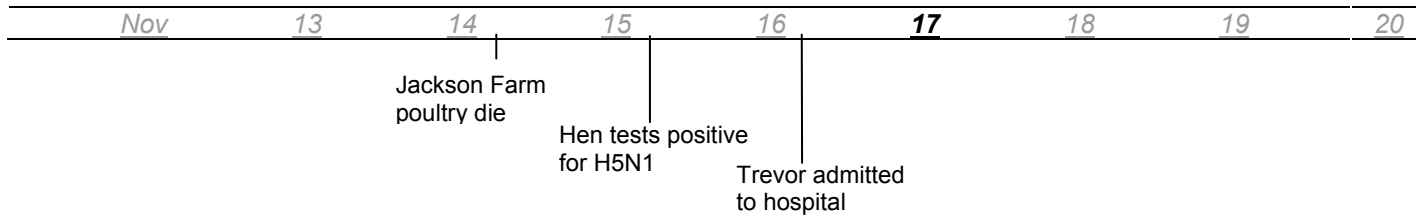
Update 9

Early in the morning on Saturday, November 17th, you receive a call from Heidi Jackson, who is at Springfield Regional Medical Center with her son Trevor. According to Heidi, Trevor came home late last night with fever and shortness of breath, and she took him to the emergency room. He was admitted to the hospital at 4am after spending a short time in the emergency room. She apologizes for not calling sooner, but she assures you that she alerted the ER staff to the possibility that Trevor had avian influenza.

You immediately send one of your RRT members to the hospital. After explaining that HIPAA regulations are waived in this type of outbreak investigation, you are provided with Trevor's medical chart. It includes the following information:

Onset of fever and shortness of breath on Nov 16th
 Moderate respiratory distress
 No significant medical history
 Initial blood count reveals low lymphocytes and leukocytes
 Vitals upon admission:
 Temperature = 101.3°F
 Respiratory Rate = 28
 Blood Pressure = 180/100
 Oxygen Saturation = 90%
 Oropharyngeal specimen collected - results are pending

Question 1 – Does Trevor meet CDC's case definition for avian influenza? If so, would his case be classified as suspect or confirmed?



Suggested answer – Yes, Trevor meets the case definition as a suspect case because he presented with fever and another symptom, had direct contact with sick poultry in the days before his symptom onset, and has a pending laboratory test.

Note: These case definitions are currently being modified by CDC, so participants should look for revised CDC Guidance for State and Local Health Departments for Conducting Investigations of Human Illness Associated with Domestic Highly Pathogenic Avian Influenza Outbreaks in Animals in the near future. Also, for international reporting, participants should refer to the case definitions issued by the World Health Organization

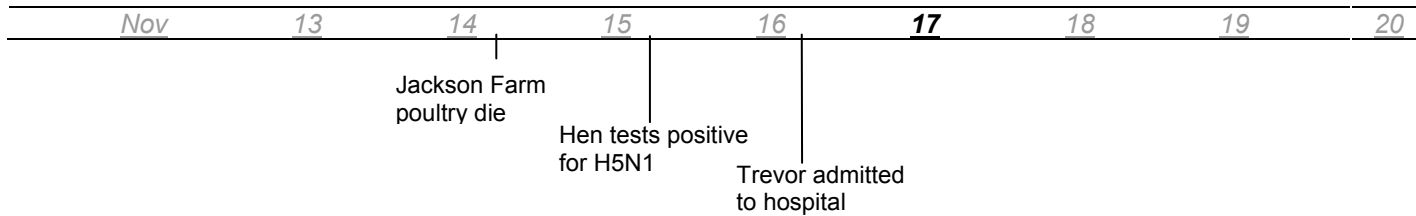
(http://www.who.int/csr/disease/avian_influenza/guidelines/case_definition2006_08_29/en/index.html).

*A **suspect** case is a person who:*

- *Has had a documented temperature of $\geq 38^{\circ}\text{C}$ ($\geq 100.4^{\circ}\text{F}$) and at least one following symptoms - cough, sore throat, and/or respiratory distress.*
- ***and***
- *Has had one of the following exposures within 10 days of the first symptom:*
 - *direct contact with (e.g., touching) sick or dead domestic poultry*
 - *direct contact with surfaces contaminated with poultry feces*
 - *consumption of raw or incompletely cooked poultry or poultry products, including blood*
 - *close contact (within 3 feet) of an ill patient who was confirmed or suspected to have H5N1 influenza*
 - *works with live H5N1 influenza virus in a laboratory.*
- ***and***
- *Has a laboratory test for H5N1 that is pending, inadequate, or unavailable.*
 - *Examples might include persons who died prior to testing or for whom testing can not be done, and persons with a positive result for influenza A by rapid antigen testing alone;*

*A **confirmed** case is a person who:*

- *Meets the clinical and exposure criteria for a Suspect Case (see above)*
- ***and***
- *Has a positive test for H5N1 influenza by one or more of the following methods:*
 - *isolation of an H5N1 influenza virus by viral culture*
 - *positive reverse transcriptase–polymerase chain reaction (RT-PCR) for H5N1*



- *positive immunofluorescence antibody test for H5 antigen, using H5N1 monoclonal antibodies*
- *4-fold rise in H5N1-specific antibody titer detected by microneutralization assay in paired serum samples*

Note: If a person tests positive by any of the methods above, but does not meet the clinical and exposure criteria, they may still be counted a confirmed H5N1 infections and treated as a confirmed case for the purpose of the investigation and follow-up.

A report under investigation is a person who

- *Does not fulfill the Suspect Case criteria, in terms of exposure or clinical characteristics because information is not yet available. Additional information is needed to classify into one of the other case classifications.*

Not a case

- *Negative for H5N1 influenza as determined by sensitive laboratory testing methods with adequate and appropriately timed specimens.*

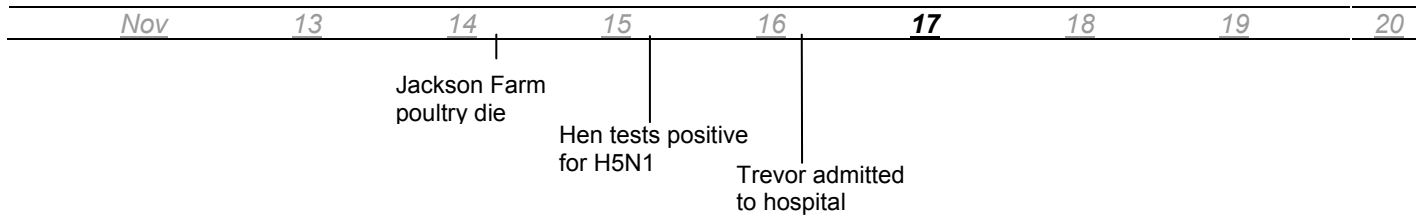
Question 2 – Is any additional information needed to classify this case?

Suggested answer – *No, but if laboratory results come back as positive or inconclusive, the classification will have to be changed.*

Question 3 – What would need to happen in order for this case to move from its current classification to the next?

Suggested answer – *Trevor would be considered a confirmed case if he had a positive test for H5N1 through one of the following methods (viral culture, RT-PCR, IFA, or 4-fold rise in H5N1 antibody titer in paired samples). Note: It is likely that CDC will need to confirm all initial U.S. cases at its own laboratory, even after positive confirmatory results from a state health department laboratory.*

Question 4 – While you are at the hospital, do you make any additional recommendations to healthcare providers or infection control practitioners there?

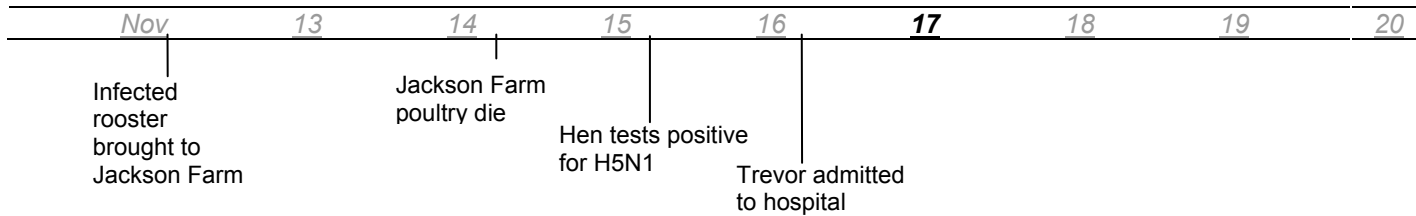


Suggested answer – Recommend that staff working with Trevor use standard, contact, droplet and airborne precautions, including fit-tested N95 respirators, when performing any aerosol-generating procedures such as intubation, suctioning of an endotracheal tube, or administering aerosolized bronchodilator medications. However, it may not be necessary for Trevor to be placed in a negative pressure room. CDC is currently revising its guidelines for control of avian influenza in healthcare settings, so recommendations are forthcoming. At a minimum, Trevor should be placed in an isolated room, and staff and visitors should observe standard, contact and droplet precautions. All bodily fluids must be considered potentially infectious: stool, blood, respiratory secretions, sputum, etc. Providers should also be advised to assess risk of avian influenza for patients with ILI.

Question 5 – Are there any other actions you would take while at the hospital?

Suggested answer – Possible responses:

- Conduct an interview with Trevor if his health permits
- Get a list of people who were in the emergency room the night Trevor was there
- Get a list of healthcare providers who have been in contact with Trevor since his arrival and begin active daily monitoring for illness for 10-14 days.
- Request information about other ILI cases admitted in the last 48 hours
- Report the suspect case to state epidemiologist. The state epidemiologist or state health director is responsible for reporting to the CDC.



J. Investigation - Case Interviewing

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 10 minutes

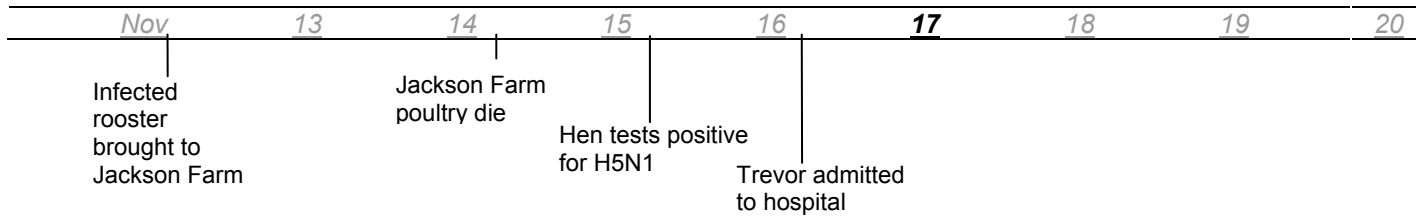
Update 10 - Morning of November 17, 2007

Although Trevor is ill, one of your RRT members was able to conduct an interview with him in the hospital. The interview uncovered the following information.

Trevor works as a mechanic at a local repair shop, and has several friends who also work there. On Monday Nov 12th, Trevor's coworker and friend, Kasen Punyawong, returned from a trip home to Pao Mai in SE Asia to visit his extended family. In Pao Mai, Kasen's family is very involved in many aspects of cockfighting, a popular sport in that country. While Kasen was visiting his family, the Pao Mai government announced a mass poultry culling operation to limit the spread of H5N1 in their country. To save the family's most prized and valuable rooster, Kasen shipped the bird into the U.S. The rooster was not detected by U.S. customs. Kasen brought the rooster to the Jackson farm on Tuesday, November 13th to show Trevor. The young men talked about how they could make a lot of money by breeding the rooster with hens from the Jackson farm. Trevor thought that the bird looked ill. He denies bringing the rooster into direct contact with the other poultry on the farm, but admits that the birds were in relatively close proximity. Trevor refuses to tell you where the rooster is now, and expresses regret at "ratting out" his friend.

Question 1 – Who should you notify about this new information?

Suggested answer – *Because the bird was smuggled illegally into the U.S., this has now become not only a public health and agriculture issue, but also a law enforcement issue. At the least, you should notify the state veterinarian (or Dept*



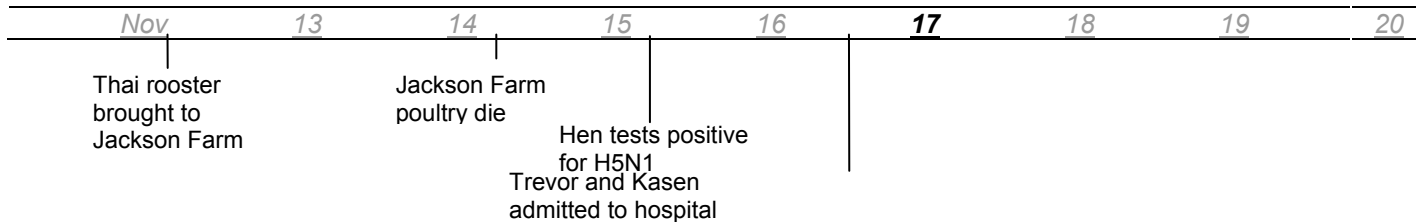
of Agriculture) immediately, local law enforcement, and US Customs and Border Protection (CBP). CBP is the federal agency with jurisdiction for enforcement of illegal imports.

Details on HPAI H5N1 - Import restrictions

- *In order to protect the U.S from the introduction of HPAI, USDA-APHIS maintains trade restrictions on the importation of poultry and poultry products originating from countries and/or regions where HPAI H5N1 strains have been detected in commercial or traditionally raised poultry.*
- *While USDA establishes the regulations for these restrictions, the DHS U.S. Customs and Border Protection (CBP) is responsible for enforcing these laws.*
- *In addition to imposing import restrictions, in general, USDA-APHIS quarantines and tests live birds imported into the U.S. to ensure that they do not have any foreign animal diseases such as the HPAI H5N1 virus.*
- *To combat the illegal importation or smuggling of pet birds and poultry, USDA maintains a special program, Smuggling Interdiction and Trade Compliance, through which officers work cooperatively with CBP Agriculture Specialists at U.S. ports of entry. These officers also educate DHS and other state and federal partners about prohibited products and restricted commodities.*

Question 2 – Are there additional potential contacts that you should now follow-up with?

Suggested answer – *The priority is to interview Kasen to get details about his travel and possible symptoms, as well as to get information about the bird. The RRT should follow-up with Kasen’s household contacts and other close contacts, especially those that may have been in contact with the smuggled bird. After following up with Kasen and his close contacts, the RRT should initiate additional contact tracing, by getting information about Kasen’s flights between Pao Mai and the U.S., and contacting his fellow passengers, as well as people who handled baggage. Together with the state Department of Agriculture and the USDA, the RRT needs to get information about exactly how the bird traveled into the U.S., where it was kept once in the U.S. and where it is located now. If the rooster was infected with H5N1 and looked ill on Tuesday, it is likely that the bird is now dead. However, depending on how the bird was smuggled into the U.S., there may be a large number of people who were in contact with the bird.*

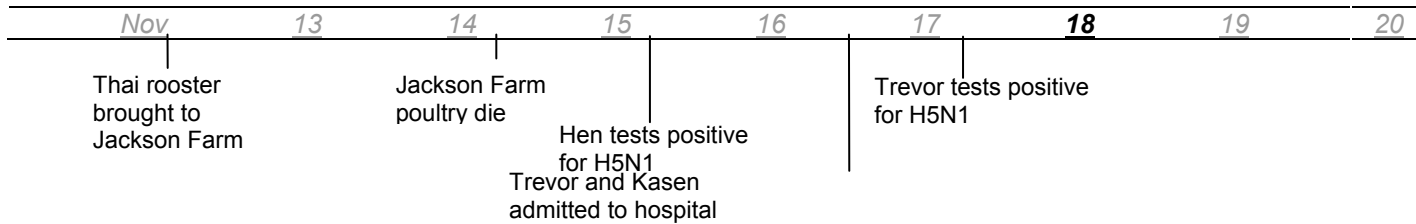


Question 1 – Do you recommend that Heidi bring Rick and/or Claire to the hospital, keep them at home, or follow another course of action?

Suggested answer – *Since their symptoms became more severe, and you know that both Rick and Claire had close contact with the poultry, they should be brought to the hospital, either by Heidi or an emergency transport vehicle. Either way, you should notify the hospital in advance that they will be arriving, and that everyone who is in contact with them should be using droplet precautions at a minimum, and preferably airborne precautions (including fit-tested N95 respirators, but not necessarily a negative pressure room).*

Question 2 – Are you communicating with the public during this time? If so, what are the key messages to convey? Through which media channels?

Suggested answer – *It is likely that communication with the public will be handled by a Joint Information Center (JIC) or state and local health directors. The JIC should conduct a joint press conference with representatives from the Department of Agriculture and Department of Public Health, as well as the Incident Commander, if the Incident Command Structure has been activated. Key messages include personal infection control practices (e.g. hand washing), food safety, update on possible human cases, update on the investigations, and advice on when to seek medical care for possible HPAI H5N1. It should also convey empathy for everyone involved in the outbreak, especially Kasen Punyawong, the Jackson family, and others who may be ill. It is important that communication be regular and proactive, and should be occurring throughout the investigation.*



L. Investigation - Infection Control

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 20 minutes

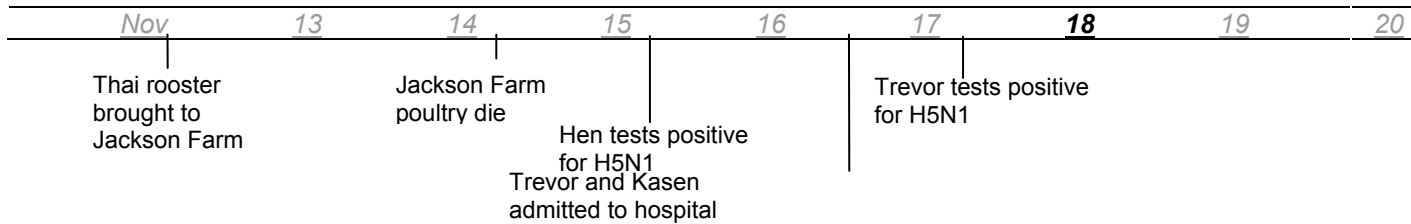
Update 12

It is Sunday morning, November 18th, and you have just learned that RT-PCR testing for Trevor is positive for H5N1. You notify your State Health Director and State Epidemiologist, who immediately call Dr. Tim Uyeki in the Influenza Division at CDC. Your State Epidemiologist instructs you to continue with your investigation while he consults with CDC about next steps. CDC staff are being deployed to the area, and will collaborate with your Rapid Response Team on the remainder of the investigation.

Through the course of the morning, you and your RRT conduct interviews with Kasen's brother and uncle, who are Kasen's only household contacts. You also interview people from the Dept of Agriculture who were first responders at Jackson farm, some of the people who visited the emergency room yesterday, healthcare workers who have been in contact with Trevor, and other responders. You have not been able to interview Kasen, because he was admitted to the hospital yesterday, and is very ill. His chest x-ray shows significant infiltration, and he has been intubated and sedated.

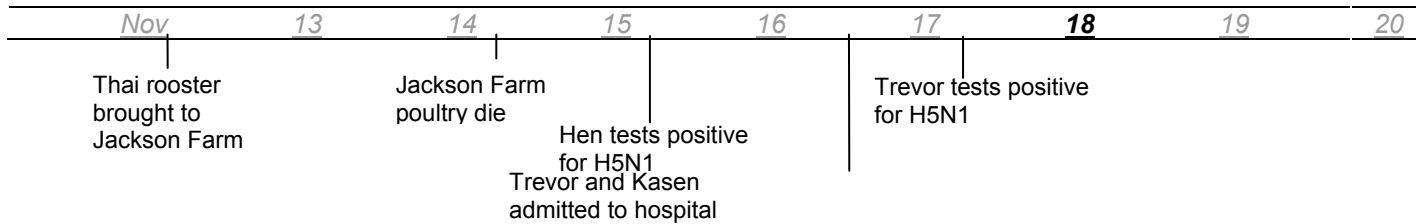
Question 1 – What infection control measures would you initiate for each of these groups: close contacts of suspected and confirmed cases, first responders to poultry outbreak, ER visitors, and healthcare workers? Discuss possible actions in the following areas:

1. Antiviral Chemoprophylaxis
2. Quarantine
3. Other non-pharmaceutical interventions (e.g. social distancing)
4. Communication



Suggested answer –

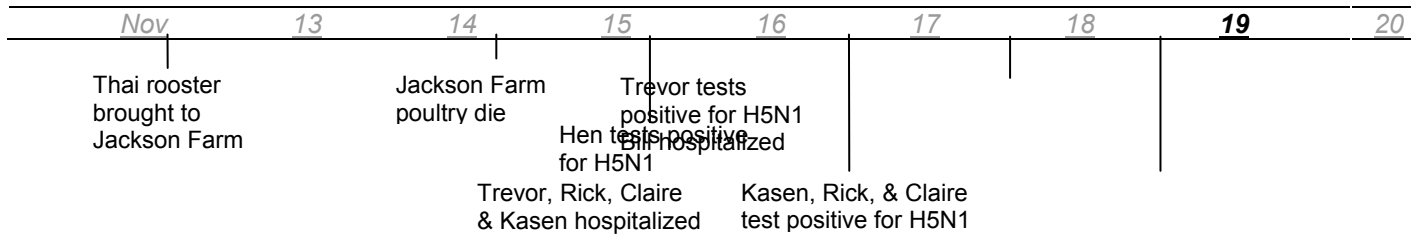
1. *Antivirals – According to recent WHO guidelines, the highest priority group for antiviral chemoprophylaxis is household family members and close contacts of strongly suspected or confirmed H5N1 patients. Therefore, oseltamivir should be administered to household or close-family contacts of Kasen, Trevor, Rick and Claire, including Kasen's brother and uncle, and the rest of the Jackson family. Groups with moderate-risk exposure are also recommended to receive antiviral chemoprophylaxis. These groups include people with unprotected and very close direct exposure to sick or dead H5N1 infected animals, people handling sick animals without proper use of PPE, and healthcare personnel in close contact with strongly suspected or confirmed H5N1 patients without proper use of PPE (Schunemann et al, 2007). Based on these WHO guidelines, chemoprophylaxis with oseltamivir should be provided to first responders to the poultry outbreak and healthcare workers in contact with suspected and confirmed cases. Note that Department of Agriculture response personnel involved control and eradication have probably already been started on antiviral chemoprophylaxis, based on the guidance in USDA directive 6800.1. However, public health should verify this with the Dept of Agriculture. In addition to antiviral chemoprophylaxis, all contacts should also receive inactivated seasonal influenza vaccine to limit the possibility of co-infection with human influenza A and H5N1 viruses and reduce the potential for viral reassortment (seasonal influenza vaccine will NOT protect against H5N1 infection). Be sure that there are plans in place to monitor adverse events following antiviral or vaccine administration. If time permits, participants may want to discuss how such monitoring would be implemented.*
2. *Quarantine – CDC guidance for contacts does not require quarantine, but asks that individuals self-monitor for symptoms. However, quarantine would be indicated if the virus was causing severe illness, or was spreading from person to person.*
3. *Other non-pharmaceutical interventions – At this point, the primary intervention is to limit contact between farms, since the only human cases to date have had close contact with sick poultry. The RRT should also emphasize the importance for handwashing and household infection control measures.*
4. *Communication – Advise all contacts to avoid touching their faces and mucous membranes (including eyes) with their hands. They should also be advised of proper hand hygiene (soap and water for at least 15-20 seconds, or hand sanitizer with a minimum of 60% alcohol).*



Question 2 – What infection control measures should you recommend to Springfield Regional Medical Center, where Trevor, Kasen, Rick, and Claire are being cared for?

Suggested answer – *Each case-patient should be placed in isolated rooms if they are not already there. Anyone entering the room should take standard, contact, and droplet precautions. People providing direct care should use fit-tested N95 or higher particle efficient respirator protection. They should also use eye protection when within 3 feet of the patient, or when entering the patient’s room if oxygen or aerosolized broncodilators are administered. These precautions should be employed until at least 14 days after the onset of symptoms. Negative pressure isolation is not required, but may be used when performing aerosol-generating procedures (e.g. intubation).*

All healthcare workers caring for case-patients should have been previously vaccinated with the seasonal influenza vaccine, and should self-monitor for fever, respiratory symptoms, and conjunctivitis. Healthcare workers with such symptoms should stay home until 24 hours after the fever has resolved (CDC, 2006, CDC, 2004). If not previously vaccinated, healthcare workers should receive inactivated influenza vaccine. Healthcare workers vaccinated with live attenuated influenza virus (LAIV) vaccine should not be caring for this patient and should not receive antiviral medications until at least one week (7 days) after receiving LAIV vaccine. The hospital should provide education and PPE to anyone entering the patient’s room, including but not limited to, respiratory therapists, housekeeping staff, and family members.



M. Investigation - Case Classification and Line Listing

Instructions:

Read the following update. In your small group, complete the activities that follow. Use case and contact list templates.

Time Allotted: 25 minutes

Update 13

It is midday on Monday, November 19th, and you have compiled a great deal of information from interviews conducted over the weekend and this morning. Below is a sample of the data.

Initial cases

- Trevor Jackson (22 y.o. male) remains hospitalized, and he is now in critical condition. Symptom onset began with fever and shortness of breath on 11/16/07. He has developed pneumonia, and blood testing has revealed low lymphocyte and leukocyte counts. His chest radiograph (below) shows evidence of lower left lobe consolidation. The positive RRT-PCR test was confirmed to be H5N1 by the CDC laboratory. Treatment with oseltamivir began on 11/17/07.



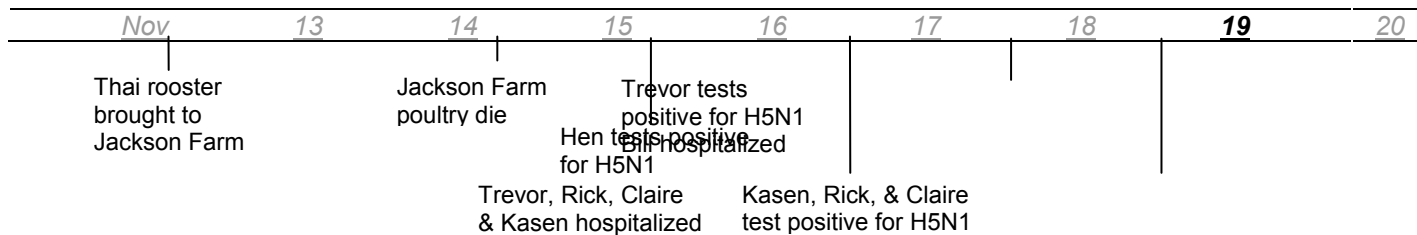
Source: Ungchusak, K, et al. *N Engl J Med* 352(4):333-340

Nov	13	14	15	16	17	18	19	20
Thai rooster brought to Jackson Farm		Jackson Farm poultry die	Trevor tests positive for H5N1 Hen tests positive for H5N1 Trevor, Rick, Claire & Kasen hospitalized	Kasen, Rick, & Claire test positive for H5N1				

- Rick Jackson (43 y.o. male) is also hospitalized, with fever (101.9°F), cough, and diarrhea. His cough began on 11/16/07, and onset of other symptoms was 11/17/07. He was admitted to the hospital late that day (Saturday the 17th). RT-PCR positive for H5N1. Oseltamivir treatment was initiated presumptively on 11/16/07.
- Kasen Punyawong (24 y.o. male) was admitted to the hospital in the morning of 11/17/07 with fever (102.1°F), severe cough, and muscle aches. His symptoms began on 11/15/07. RRT-PCR was positive for H5N1, and his chest radiograph shows significant infiltration. He required mechanical ventilation on 11/17/06 and remains sedated. Oseltamivir treatment was initiated on 11/17/07.
- Claire Jackson (15 y.o. female) is hospitalized in stable condition. Cough and sore throat began on 11/16/07, fever and muscle aches on 11/17/07. Oseltamivir treatment was initiated presumptively on 11/16/07. RT-PCR positive for H5N1.

Additional Interviews

- Interview #1 – Heidi Jackson (wife of Rick). 41 y.o. female. No symptoms. Oseltamivir chemoprophylaxis initiated on 11/16/07.
- Interview #2 – Lisa Jackson (daughter of Rick), 18 y.o. female. No symptoms. Oseltamivir chemoprophylaxis initiated on 11/16/07.
- Interview #3 – Bill Zalesky (neighbor of Rick), 68 y.o. male. Fever, severe cough, sore throat, and shortness of breath began on 11/17/07. Admitted to hospital on 11/18/07. Blood testing has revealed low lymphocyte counts, moderately low platelet counts, and increased aminotransferases (liver enzymes). Treatment with oseltamivir was initiated on 11/18/07. RT-PCR influenza test results pending.
- Interview #4 – Jim Baxter (Dept of Ag first responder), 40 y.o. male. Fever, body aches, and shortness of breath began on 11/18/07. Admitted to hospital and treated with oseltamivir today (11/19/07). Laboratory results pending.
- Interview #5 – Shana Patel (ER nurse), 26 y.o. female. Fever, cough, and sore throat began this morning (11/19/07). No international travel, or known contact with poultry, but she does spend time outdoors in areas where waterfowl may be present. Cared for Trevor Jackson in the ER on 11/16/06. Treatment with oseltamivir will begin today. Laboratory results pending.
- Interview #6 – Pravat Punyawong (Kasen's brother), 21 y.o. male. No symptoms. Had contact with rooster on 11/13/07. Spent time with brother from 11/13/07 till 11/17/07, when he brought Kasen to the hospital. Oseltamivir prophylaxis initiated on 11/18/07.



Question 1 – Classify each of the above as a suspect case, confirmed case, or contact.

Suggested answer –

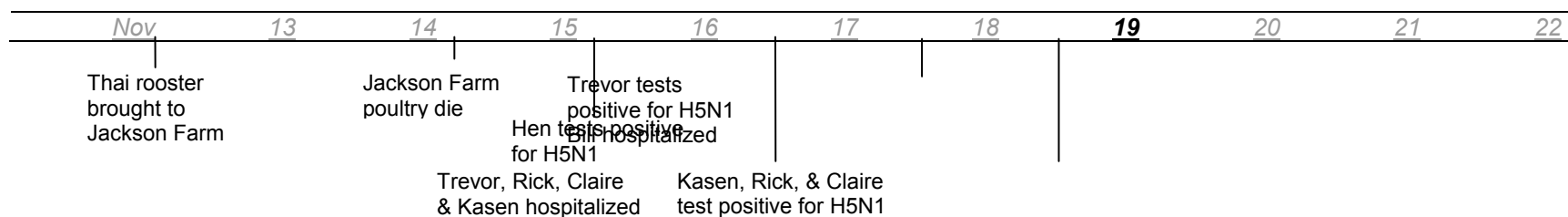
Trevor Jackson, Kasen Punyawong, Rick Jackson, Claire Jackson – confirmed cases

Bill Zalesky, Jim Baxter, Shana Patel – suspect cases

Pravat Punyawong, Heidi and Lisa Jackson – contacts

Question 2 – A line list of cases is included on the following page. Please discuss any additional information that should be added to the line list.

Suggested answer – *The line list should include all of the personal, clinical, and exposure information necessary to classify and reclassify cases. Other variables that could be included are: interview date, interviewer initials, date of poultry exposure, dates of exposure to ill persons and confirmed cases, type of monitoring, date prophylaxis began, date of specimen collection, specimen type, results of last laboratory test, treatment (type and date), type of hospital care (e.g. ICU or not), presence of pneumonia, status of patient (e.g. stable, critically ill), and any additional data from health checks*



Case Linelist

ID	First Name	Last Name	Age	Sex	Case Status	Date of Onset	Symptoms*	Possible Exposure	Laboratory Results	Status
1	Trevor	Jackson	22	M	Conf	11/16	F,C,D	Poultry	+	Hospitalized
2	Kasen	Punyawong	24	M	Conf	11/15	F,C,M	Poultry	+	Hospitalized
3	Rick	Jackson	43	M	Conf	11/16	F,C,D	Poultry	+	Hospitalized
4	Claire	Jackson	15	F	Conf	11/16	F,C,ST,M	Poultry	+	Hospitalized
5	Bill	Zalesky	68	M	Susp	11/17	F,C,SOB,ST	Poultry	Pending	Hospitalized
6	Jim	Baxter	40	M	Susp	11/18	F,SOB,M	Poultry	Pending	Hospitalized
7	Shana	Patel	26	F	Susp	11/19	F,C,ST	Case #1 or wild birds	Pending	Hospitalized

*F=fever, C=cough, D=diarrhea, SOB=shortness of breath, ST=sore throat, M=muscle aches

Nov	13	14	15	16	17	18	19	20
Thai rooster brought to Jackson Farm		Jackson Farm poultry die	Trevor tests positive for H5N1 Hen tests positive for H5N1 Trevor, Rick, Claire & Kasen hospitalized	Kasen, Rick, & Claire test positive for H5N1				

Question 3 – A line listing of contacts is included below. Again, please discuss any additional information that should be added to the list.

Suggested answer – *The line list should include all of the personal, clinical, and exposure information necessary to classify and reclassify cases and contacts. Some other variables that could be included are: interview date, interviewer initials, date of poultry exposure, dates of exposure to ill persons and confirmed cases, type of monitoring, date prophylaxis began, date of specimen collection, specimen type, results of last lab test treatment (type and date), and any additional data from health checks*

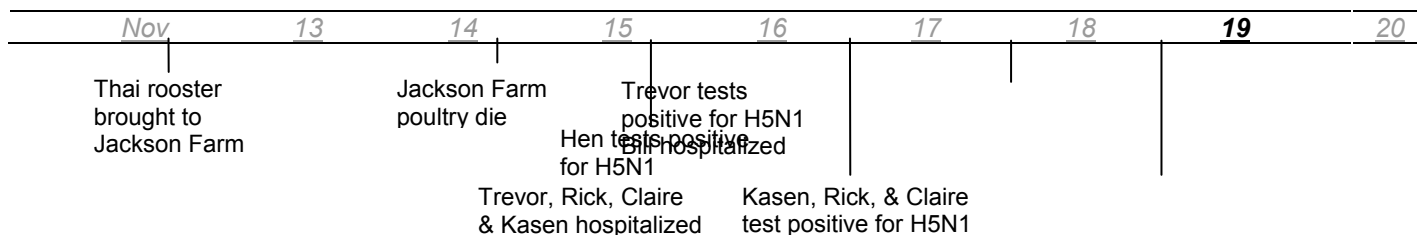
Contact Tracing Linelist

ID	First Name	Last Name	Age	Sex	Relationship to Case	Possible Exposure Type	Possible Exposure Date
1	Heidi	Jackson	41	F	Rick's wife	Poultry or Case #2	?
2	Lisa	Jackson	18	F	Rick's daughter	Poultry or Case #2	?
3	Pravat	Punyawong	21	M	Kasen's brother	Poultry	11/13/07

Question 4 – Discuss the significance of Interview #5 (Shana Patel), and specific actions that you would take in response to this information.

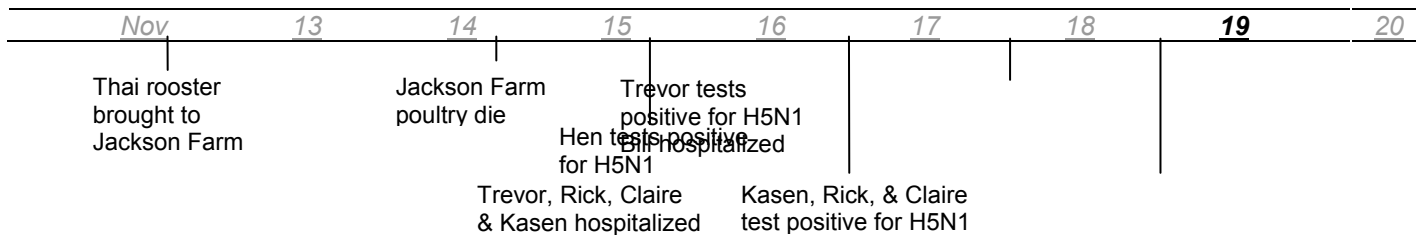
Suggested answer – *This case may have resulted from human-to-human transmission. Shana has no reported direct contact with poultry, but did have close contact with a confirmed case. The fact that she may have been in contact with droppings from wild birds makes the interpretation more complicated; however, there has been no indication that wildlife officials have detected HPAI in wild birds. The most important initial recommendation is that Shana be hospitalized, isolated, and evaluated by a clinician. Specimens should be collected for RT-PCR, and she should be treated with oseltamivir as soon as possible. The RRT may want to conduct a more detailed interview with Shana, but in the meantime proceed as if human-to-human transmission has occurred. Possible actions are listed below:*

- *Surveillance – alert hospitals and healthcare providers to the possibility of human-to-human transmission and the expected increase in cases, recommend*



using PPE with anyone presenting with ILI, and keeping patients with possible H5N1 infection in isolated rooms. If active surveillance has not been initiated at Springfield Regional Medical Center, it should be started at this point. It may also be prudent to implement active monitoring of healthcare workers, if this is not already occurring.

- *Disease Containment – the possibility of human transmission makes disease containment measures even more important. Participants may want to discuss triggers for providing mass antiviral prophylaxis to all contacts and community members in the area. At the least the RRT should recommend voluntary quarantine to all contacts of suspected and confirmed cases to limit the possibility for additional transmission. The team should prioritize case finding and contact tracing activities (by adding additional interviewers, if necessary).*
- *Communication – the public should be informed to practice proper hand hygiene, avoid touching their face or mucous membranes with their hands, and watch for symptoms of ILI in themselves and their families.*



N. Investigation - Specimen Collection

Instructions:

Read the following update. In your small group, discuss the questions that follow.

Time Allotted: 15 minutes

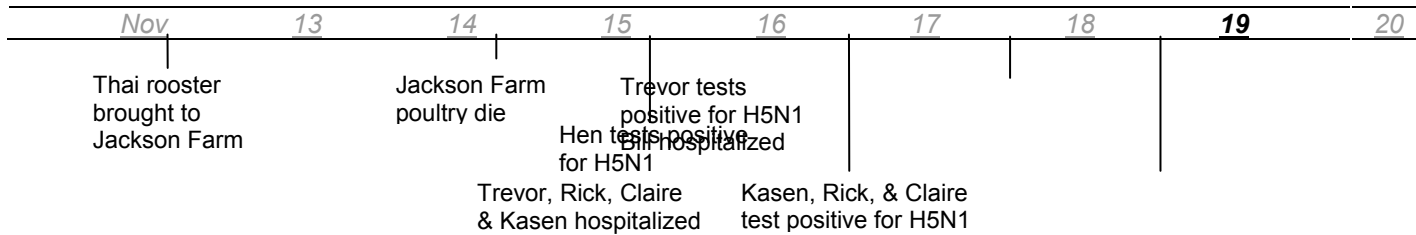
Update 14

This afternoon (Nov 19th), you conduct an interview with Abby Crawford, a good friend of Claire Jackson's. She and Claire spend a lot of time together, and she was with Claire the day before Claire's symptoms first appeared. During the course of your interview, she reports that she has a cough and body aches that began this morning. You recommend that she be evaluated by a clinician, started on oseltamivir treatment presumptively, and admitted to the hospital. Before you leave, though, you need to decide whether to collect specimens from Abby.

Question 1 – Should you collect a specimen from Abby? If so, which specimens should be collected?

Suggested answer – Participants can refer to the materials for the laboratory module that will be included in the optional third day of training.

Yes, you should collect a specimen from Abby. She is a close contact of a suspect case (Claire Jackson), and there is a slight possibility that human-to-human transmission could have occurred between Trevor Jackson and Shana Patel, the ER nurse. The preferred specimen for human cases of H5N1 are lower respiratory tract specimens, if available (e.g. a person is intubated). If not available, then oropharyngeal specimens are the best upper respiratory tract specimen, because they appear to contain more virus for H5N1 detection than nasal or nasopharyngeal specimens. Nasal swabs are acceptable, but are less desirable because they may contain less H5N1 virus (CDC HAN, 2006). Respiratory specimens should be collected from multiple sites on multiple days from the same patient with suspected H5N1. If possible, specimens should be



collected within 3 days of illness onset. You may also consider collecting blood (now during the acute phase AND later during the convalescent phase) for paired serology testing.

Question 2 – If you chose to collect a specimen, please describe the procedure for specimen collection, including necessary personal protective equipment. Be sure to note how and where the specimen(s) should be transported.

Suggested answer – RRT members should collect oropharyngeal and nasal swab specimens and use contact and droplet precautions, as well as an N95 or better respirator. The procedure for oropharyngeal specimen collection is:

- Use sterile Dacron or rayon swabs with plastic shafts
- Swab the posterior pharynx and tonsillar areas, avoiding the tongue
- Place swabs immediately into sterile vials containing 2ml of viral transport media. Break the applicator sticks near the top and tighten the cap. Label each specimen container with the patient's name, ID number, and date the sample was collected.

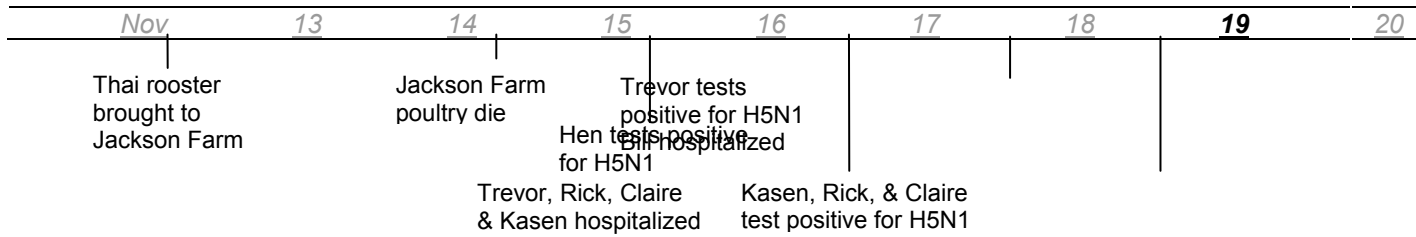
Refrigerate samples after collection. Keep sample at 4°C using cold packs if necessary.

Ship samples to a laboratory that can conduct RT-PCR testing for H5 (notify laboratory that specimen will be arriving). This will often be the state laboratory. CDC may also request that you send specimens to their laboratory as well.

Participants should discuss specific aspects of specimen collection, handling, and transport in their local areas. Which laboratory should specimens be sent to? Is the process different since it's a Sunday? How will the RRT be notified of the laboratory results?

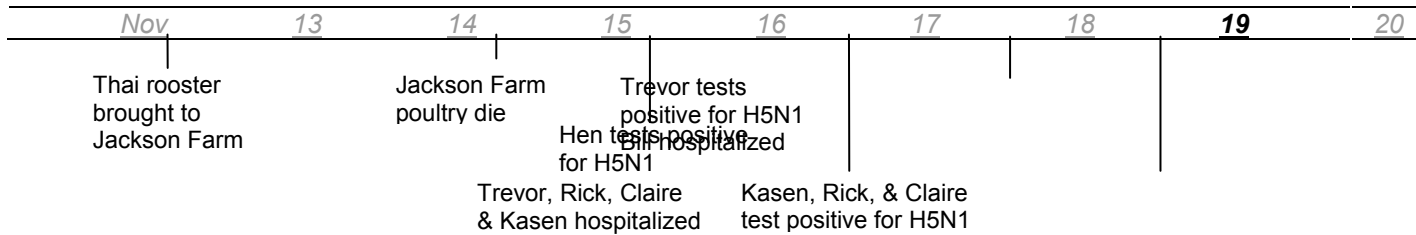
Question 3 – Should any additional specimens be collected from Abby either now or in the future?

Suggested answer – Acute serum samples should be collected not more than 7 days from the date of symptom onset (in this case today – 11/19/07)). Convalescent samples should be collected at least 21 days after illness onset.



Question 4 – Should you collect specimens from asymptomatic contacts of suspect, probably, and/or confirmed cases?

Suggested answer – *The current CDC guidelines do not recommend laboratory testing of contacts, but factors including the epidemiology of the outbreak may affect the decision to test asymptomatic contacts.*



O. Investigation - Assessing Human-to-Human Transmission

Instructions:

Read the following update. In your small group, discuss the questions that follow.

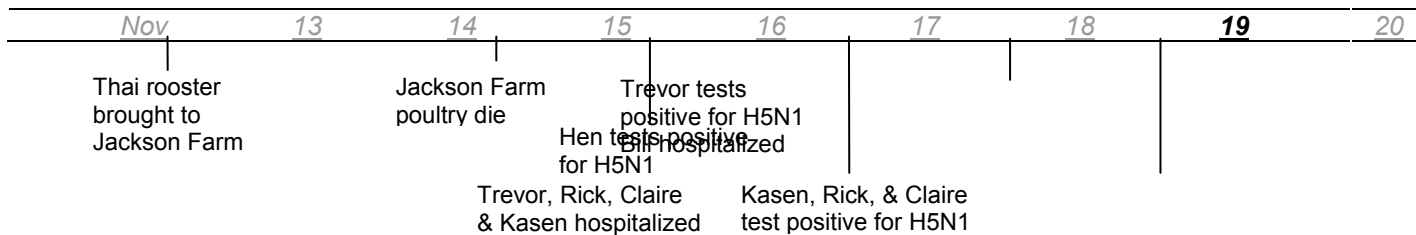
Time Allotted: 20 minutes

Update 15

You now have 2 suspect cases (Shana Patel, the ER nurse, and Abby Crawford, Claire's friend) in which human-to-human transmission of H5N1 virus seems possible. To assess the possibility that Shana and Abby contracted illness from wild birds, you contacted your state Department of Fisheries and Wildlife. They have stepped up their surveillance of wild birds in response to the Jackson Farm outbreak, but have not found any birds that are positive for H5N1 virus yet. In addition, nationwide surveillance has not detected the H5N1 virus elsewhere in the country.

Question 1 – How do you determine whether human-to-human transmission has occurred in this outbreak?

Suggested answer – Assessment of human-to-human transmission is based upon an epidemiological investigation. The RRT should get detailed information on Shana's and Abby's activities and contacts over the past several days. The team should compare the onset dates to the incubation period of influenza to determine whether human-to-human transmission is possible. It will also be very useful to determine the current seasonal influenza activity, and other differential diagnoses that were considered by their physicians. Creating a timeline and an epi curve may be helpful to answer this question. Wildlife authorities have not detected the H5N1 influenza virus in wild birds and neither Shana nor Abby reported any contact with poultry, so human-to-human transmission is at least plausible. However, it is important to rule out all possibilities, including the chance that they were infected with undercooked poultry or eggs that originated at Jackson Farm or that they have another disease, such as seasonal influenza.

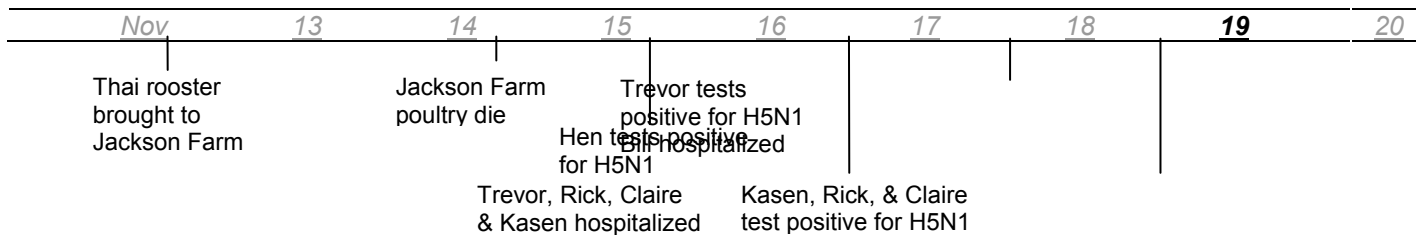


*****Facilitator: Please *INTERRUPT* participants during their discussion of Question 1. Read the following update and the question that follows. Have participants finish the human-to-human transmission discussion after answering the media scenario.*****

Your phone rings. The caller identifies himself as Anderson Cooper from CNN. He says, “I’m doing a special report tonight about the outbreak of H5N1 in your area. Right now I’m on site at Jackson Farm, and I’d like to get some information on the investigation into possible human cases. Is it true that this bird flu is being transmitted from person to person?”

Question 2 – Quickly prepare a response to Mr. Cooper based on the current situation.

Suggested answer – Although responses may vary, it is probably not the responsibility of the RRT to communicate directly with the media. The RRT should refer Mr. Cooper to the health department’s Public Information Officer or the Joint Information Center that is operating during the investigation.



P. Investigation - Daily Report

Instructions:

Below is an example of a daily situation report that is used during outbreak investigations. It provides a way to organize and summarize information that might be gathered during each day of an investigation. Fill out Sections 1, 6, and 7 using data from November 19th of the Jackson Farm case study. The other sections have already been completed. Please answer the question that follows.

Time Allotted: 20 minutes

Daily Situation Report

Date: November 19, 2007 Location(s) Visited: various interview sites

1. Rapid Response Team Composition

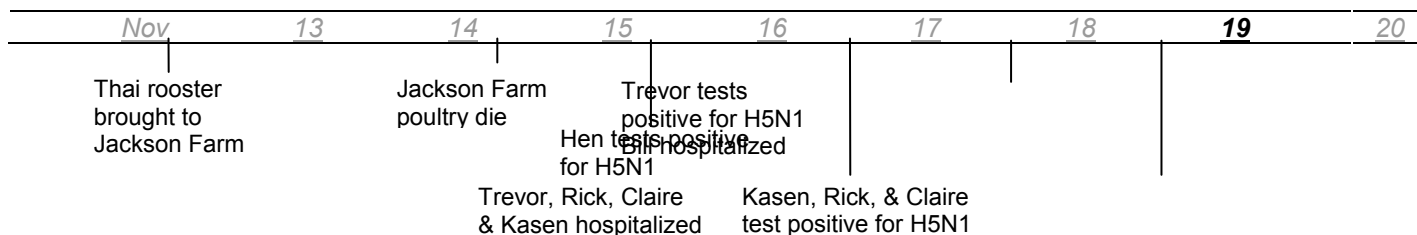
<u>Name</u>	<u>Affiliation</u>	<u>Role</u>

2. Surveillance/Epidemiology

2a. Update on Human Cases

As of Nov 19th there are 4 confirmed, and 4 suspect cases of Influenza H5. All confirmed cases and 3 of the suspect cases are hospitalized.

2b. Previously Reported Cases



Case #1: Trevor Jackson, 22 y.o. male. Symptom onset 11/16/07, hospitalized 11/17/07. RT-PCR positive for H5N1. Oseltamivir treatment initiated 11/17/07. Contact with ill poultry.

Case #2: Rick Jackson, 43 y.o. male. Symptom onset 11/16/07, hospitalized 11/17/07. RT-PCR positive for H5N1. Oseltamivir treatment initiated 11/16/07.

Case #3: Kasen Punyawong, 24 y.o. male. Symptom onset 11/15/07, hospitalized 11/17/07, RT-PCR positive for H5. Oseltamivir treatment initiated 11/17/07. Close contact with ill poultry.

Case #4: Claire Jackson, 15 y.o. female. Symptom onset 11/16/07, hospitalized 11/17/07. Oseltamivir treatment initiated on 11/16/07. RT-PCR positive for H5N1.

2c. New Cases (all suspect)

Case #5: Bill Zalesky (neighbor of Rick), 68 y.o. male. Symptom onset 11/17/07. Admitted to hospital on 11/18/07. Low lymphocyte counts, moderately low platelet counts, and increased aminotransferases (liver enzymes). RT-PCR influenza test results pending. Oseltamivir treatment initiated on 11/18/07.

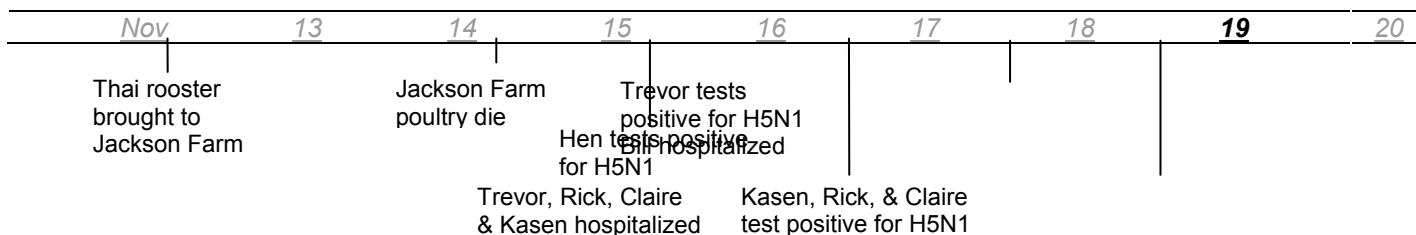
Case #6: Jim Baxter (Dept of Ag first responder), 40 y.o. male. Symptom onset 11/18/07. Treatment with oseltamivir began today (11/19/07). Laboratory results pending.

Case #7: Shana Patel (ER nurse), 26 y.o. female. Symptom onset 11/19/07. No international travel or known contact with poultry. Cared for Trevor Jackson in the ER on 11/16/06. Laboratory results pending. Oseltamivir treatment initiated today (11/19/07).

Case #8: Abby Crawford (friend of Claire) 16 y.o. female. Symptom onset today (11/19/07). Treatment with oseltamivir began today (11/19/07). Laboratory results pending.

2d. Contact Tracing

Contact #1: F, age 41, wife of Case #2. Oseltamivir prophylaxis initiated 11/16/07. Denies any symptoms.



Contact #2: F, age 18, daughter of Case #2. Oseltamivir prophylaxis initiated 11/16/07. Denies any symptoms.

Contact #3: M, age 21, brother of Case #3. Oseltamivir prophylaxis initiated 11/18/07. Denies any symptoms.

Contact #4: M, age 48, uncle of Case #3. Oseltamivir prophylaxis initiated 11/18/07. Denies any symptoms.

3. Laboratory

Oropharyngeal specimens taken from all 5 suspected cases. All specimens forwarded to the state health laboratory for diagnosis and subtyping.

4. Clinical Management/Infection Control

Contacts are being advised to remain at home for 7 -10 days after their last contact with poultry or a person under investigation. Contacts have been educated about risk factors/risk behaviors of exposure, and the signs/symptoms of HPAI H5N1 illness. All contacts have received instructions on how to self-monitor and report signs and symptoms, especially fever. They have also been instructed on seeking healthcare if symptoms become severe.

5. Animal Health

Remaining Jackson Farm poultry culled on 11/16/07. Environmental specimens taken from Jackson Farm. Results pending.

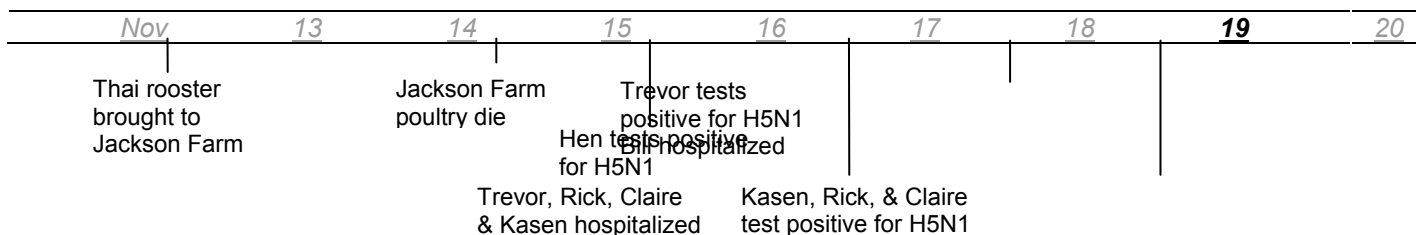
Samples from the first dead hen tested positive for H5N1 (RT-PCR) at the National Veterinary Services Laboratory. Pathogenicity results are expected shortly, although the high poultry mortality and confirmation of HPAI in humans make these results less urgent.

Note: If the USDA or State Department of Agriculture has decided to cull additional poultry within a particular radius of Jackson Farm, that information would be included in this section of the report.

6. Planned Activities

Continue monitoring known contacts for signs and symptoms.

Continue tracing contacts in three categories: people who had contact with the Jackson Farm poultry, people who were in contact with the Thai rooster, and people who have been in contact with one of the suspect or confirmed human cases. Some groups to trace include: Kasen's family, people who may have had contact with the fighting cock



between Thailand and U.S., healthcare workers at Springfield Regional Medical Center, people in the ER with Trevor, and people who purchased poultry products from Jackson Farm prior to the outbreak.

Visit (or telephone) each contact daily for at least 10 days following a known exposure to an AI case.

Report cases to appropriate authority. *Facilitator should elicit information from states about whether novel flu viruses are reportable (by law) in their states.*

Other Activities: _____

7. Requests for assistance and resources

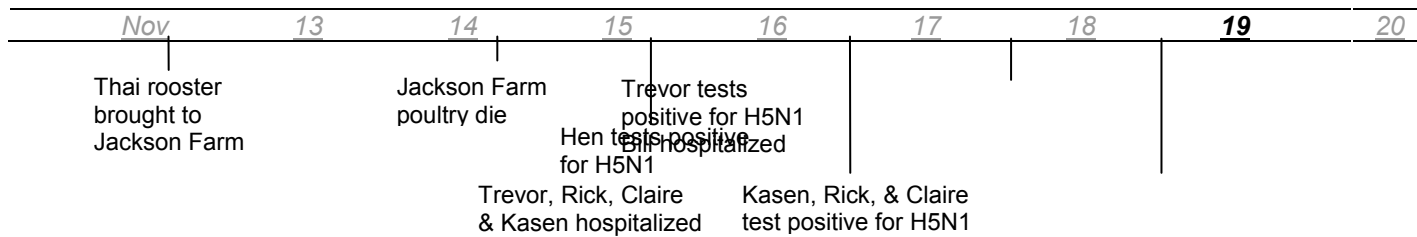
8. Other

You may want to include your line listing. In addition, issues you may want to discuss here are:

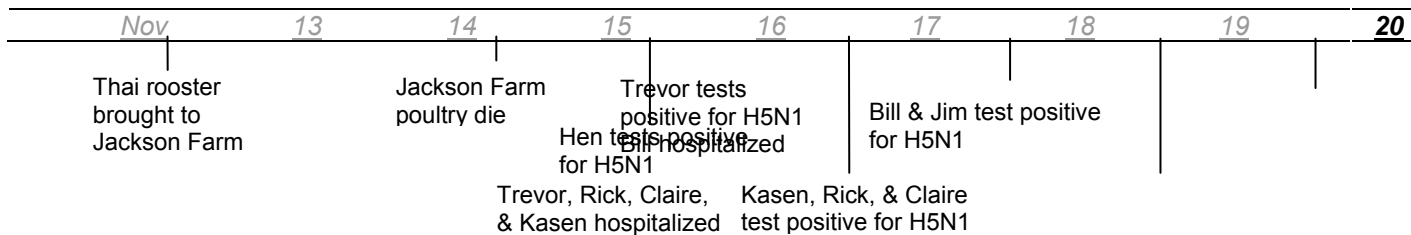
- Media issues
- Law enforcement issues related to the smuggling of the fighting cock
- Additional concerns

Question 1 – This is one example of a daily report that could be used in an outbreak situation. How might this kind of report be used by non-public health agencies? Consider possible additions and modifications that would be necessary before sharing the report.

Suggested answer – *A summary version of this report could be shared with the state Department of Agriculture and/or the USDA on a daily basis. It may not need to include as much data on individual cases and contacts. If the outbreak progresses to a situation where Emergency Management is involved, it might also be shared with incident commanders and/or emergency management personnel.*



As in other outbreak situations, this type of report is useful for communication between various public health agencies, including the CDC and the WHO.



Q. Investigation - Epi Curve

Instructions:

Read the following update. As a group, create an epi curve based on what you know to date. Choose one group member to draw the epi curve on a flip chart. Then, discuss the question that follows.

Time Allotted: 30 minutes

Update 16

It is the afternoon of November 20th, and you and your team continue to trace contacts and conduct interviews throughout the area. Updated information on suspected cases and contacts is included below.

Laboratory results are now available for many suspect cases. The following people have now tested positive for H5 and are **confirmed cases** (date of onset in parentheses):

- Kasen Punyawong (11/15/07)
- Trevor Jackson (11/16/07)
- Rick Jackson (11/16/07)
- Claire Jackson (11/16/07)
- Bill Zalesky (11/17/07)
- Jim Baxter (11/18/07)

Suspect cases awaiting laboratory results are:

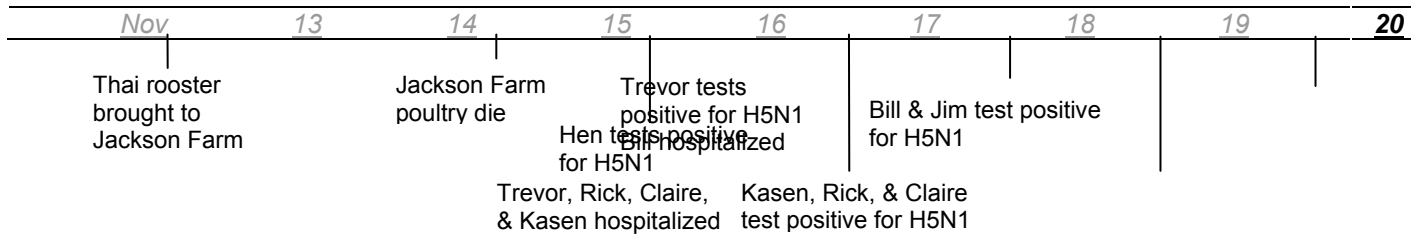
- Abby Crawford (11/19/07)

People whose laboratory tests have been **negative for H5** are:

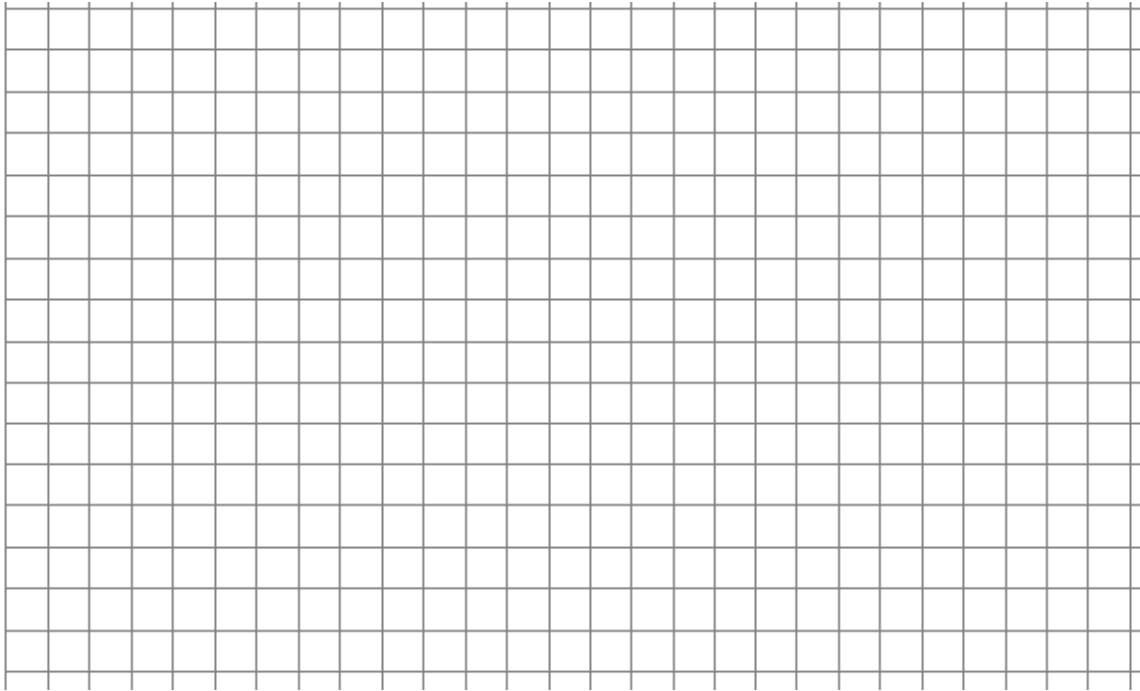
- Shana Patel (positive for influenza A subtype H1 - seasonal influenza)

Asymptomatic contacts who did not have a laboratory test are:

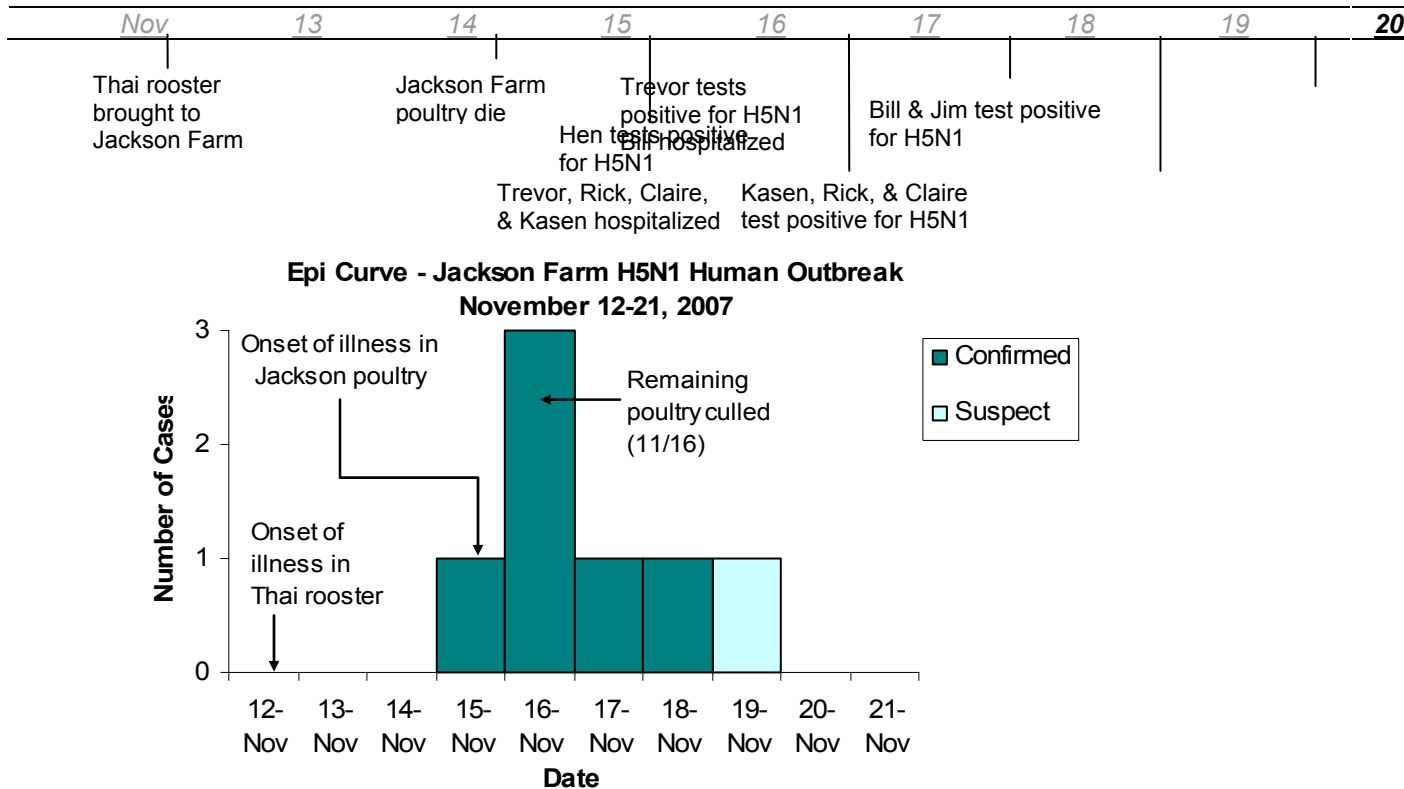
- Heidi Jackson
- Lisa Jackson
- Pravat Punyawong



Group activity – Using the data above and your case line listing, create an epi curve using the graph paper below. (Note: It may be useful to indicate the onset of illness in poultry on your curve.)



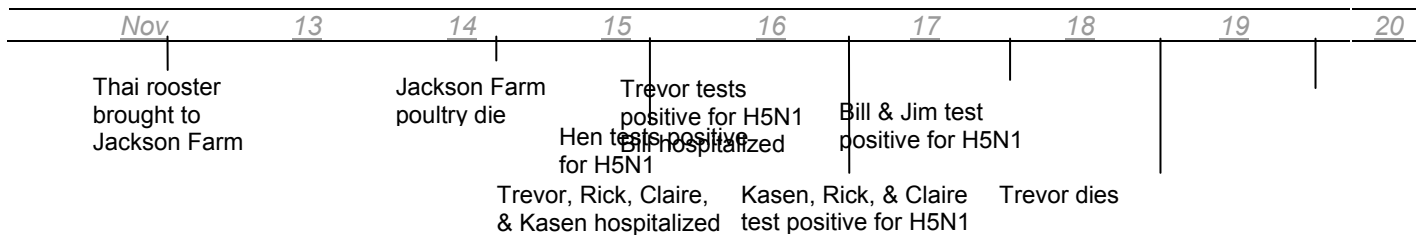
Suggested answer – The epi curve to date is below.



Question 1 – What does the epi curve tell you about the outbreak?

Suggested answer – Kasen (onset 11/15) had extensive contact with the index bird since Nov 12th so the date of infection is unknown, but it's likely that his incubation period is 3-4 days. Trevor had contact with the index bird on Tuesday (11/13), and developed illness on Friday (11/16), so probably had a 3 day incubation period. Rick and Claire (onset 11/16) had contact with the Jackson Farm poultry, but not the index bird, for several days prior to coming down with symptoms, but it is likely that their incubation periods were about 1-2 days. The case on Nov 17th, Bill Z, had contact with the sick poultry on the 15th, which would also indicate a 2 day incubation period. Finally, Jim Baxter (onset 11/18) had contact with the dead birds on Nov 16th, indicating a 2 day incubation period.

Participants should be encouraged to indicate the potential source of exposure (poultry or human) for each case in the epi curve to understand more about the spread of the outbreak. Human-to-human transmission would indicate that this is a propagated outbreak, so getting more information from Abby Crawford, the suspect case with disease onset of 11/19, is crucial. It is also likely, at this early stage, that the epi curve is not yet complete because case finding is ongoing.



R. Investigation - Mass Antiviral Chemoprophylaxis

Instructions:

Read the update below, which includes information from the World Health Organization's pandemic influenza draft protocol for rapid response and containment (May 2006). Discuss whether the current situation meets the WHO guidelines for mass administration of prophylaxis.

Time Allotted: 15 minutes

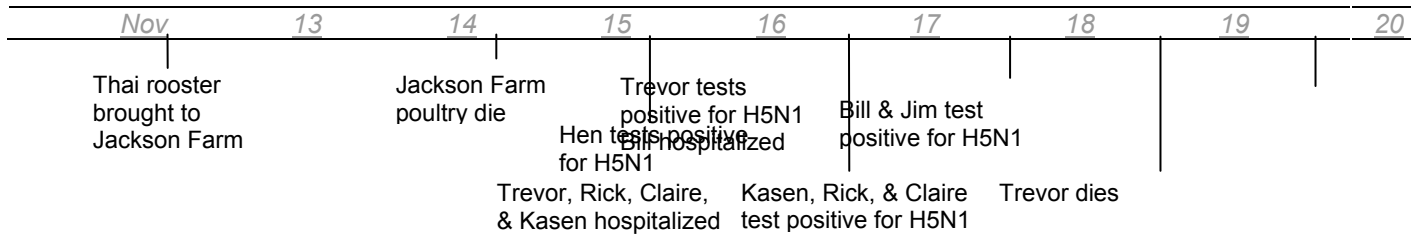
Update 17

Today is Wednesday November 21st, and the H5N1 outbreak is all over the news. CDC staff members, including an EpiAid team, have been in town for several days, as has a response team from the USDA, and it seems as though the entire state health department has taken up residence in Springfield County. However, the most pressing issue facing you today is related to antiviral chemoprophylaxis. The community, led by the principal of Springfield High School (where Rick Jackson teaches), is demanding that the health department provide antiviral chemoprophylaxis to the entire community. To determine how to respond, you decide to consult the *WHO pandemic influenza draft protocol for rapid response and containment*. * A summary of relevant information is below.

The idea for mass antiviral chemoprophylaxis is to prevent a pandemic by providing antiviral chemoprophylaxis to everyone in a particular geographic area. For disease containment, WHO recommends administering antiviral medication to at least 90% of the population in the targeted area through one of two methods:

- 1) Mass chemoprophylaxis of the affected population within 5-10km from each detected case
- 2) Targeting administrative areas (i.e. census blocks, counties) to cover the "at risk" population (10,000-50,000 people)

Each person receives a single course of oseltamivir for 10 days.



According to the WHO, rapid containment measures, including mass prophylaxis, should be used if there is **evidence of improved human-to-human transmission**. The following criteria can be used to determine whether the virus is more efficiently moving between persons:

“1. Clustering of cases of moderate-to-severe respiratory illness (or deaths) with two generations of transmission in a health care facility, and laboratory confirmation of H5N1 infection in at least one of them. The cases could be three or more health care workers who have no known exposure other than contact with ill patients, or just one health care worker and additional patients with evidence of nosocomial infections.

2. Moderate-to-severe respiratory illness (or deaths) in 5 to 10 persons with evidence of human-to-human transmission in at least some as determined by temporal sequencing of onset dates of cases and opportunities among cases for exposures to one another consistent with respective infectiousness and incubation period. At least 2 of these persons should have a laboratory-confirmed H5N1 infection....”

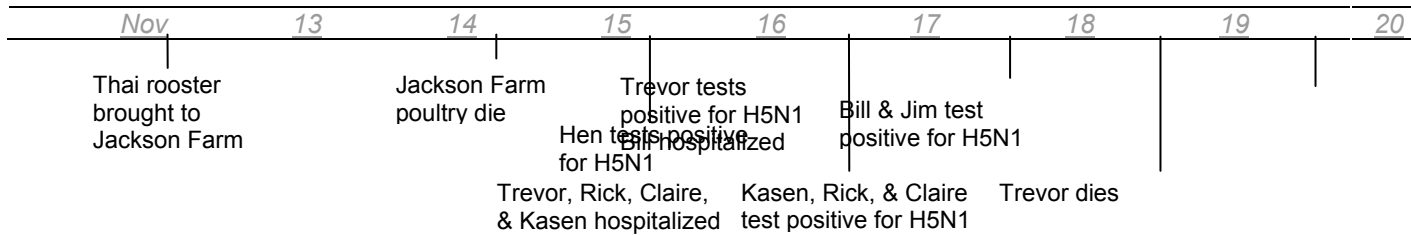
* Note: At the time of writing, WHO was revising its updated guidelines for investigation of human cases of avian influenza A (H5N1). Rapid responders should check this website for updated guidelines - http://www.who.int/csr/resources/publications/influenza/WHO_CDS_EPR_GIP_2006_4/en/index.html

Question 1 – Based on the WHO guidance above, do you think that administration of mass antiviral chemoprophylaxis is indicated in this situation?

Suggested answer – *No, mass antiviral chemoprophylaxis is not indicated in this situation because there is no evidence yet of human-to-human transmission.*

Question 2 – How do you respond to the public?

Suggested answer – *Throughout the message, demonstrate empathy for the public, and especially those affected directly by the outbreak. Reassure the public that the disease is not spreading between people, and so antiviral chemoprophylaxis is not necessary for people who do not have contact with poultry. Tell them that they will be provided with regular (at least daily) updates – and follow through. Use this as a teachable moment and remind them how to*



prevent influenza transmission in general, BUT be sure to emphasize the difference between seasonal influenza and H5N1. Assure the public that local, state, and federal public health officials are closely monitoring data related to influenza-like illness, and that seasonal influenza has been detected in the area already. Specifically, note that one healthcare worker who cared for a patient with H5N1 became ill with seasonal influenza, not H5N1. This may be a good time to emphasize to the public that seasonal influenza vaccine is available, and to remind the public that we expect outbreaks of seasonal influenza every year. However, be very clear that seasonal influenza vaccination does not protect against H5N1. To the extent possible based on the epidemiology of the H5N1 outbreak, differentiate between signs and symptoms of seasonal influenza v. H5N1.

Question 3 – Whether or not you think mass antiviral chemoprophylaxis is indicated in this situation, please discuss how you would decide which people should receive antiviral chemoprophylaxis. In other words, how do you identify your target population?

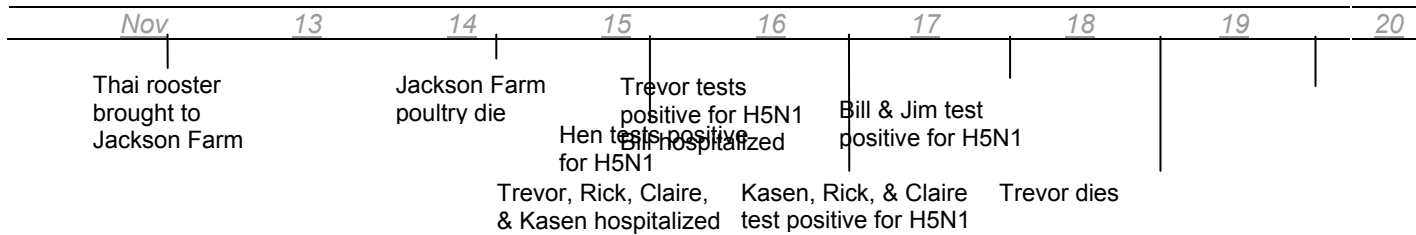
Suggested answer – *This is a difficult issue, but decisions should be made based on risk of exposure. Participants should be encouraged to discuss how they would assess risk of exposure among different groups within the community. The World Health Organization has stratified exposure groups as follows (Schunemann et al, 2007):*

“High-risk exposure groups are currently defined as:

- *Household or close family contacts of a strongly suspected or confirmed H5N1 patient, because of potential exposure to a common environmental or poultry source as well as exposure to the index case.*

Moderate-risk exposure groups are currently defined as:

- *Individuals with unprotected and very close direct exposure to sick or dead H5N1 infected animals or to particular poultry that have been implicated directly in human cases*
- *Persons involved in handling sick animals or decontaminating known infected animals or environments, if personal protective equipment might not have been used properly*



- *Health-care personnel in close contact with strongly suspected or confirmed H5N1 patients, for example during intubation or performing tracheal suctioning, or delivering nebulised drugs, or handling inadequately screened/sealed body fluids without any, or with insufficient, personal protective equipment. This also includes laboratory personnel who might have an unprotected exposure to virus-containing samples.*

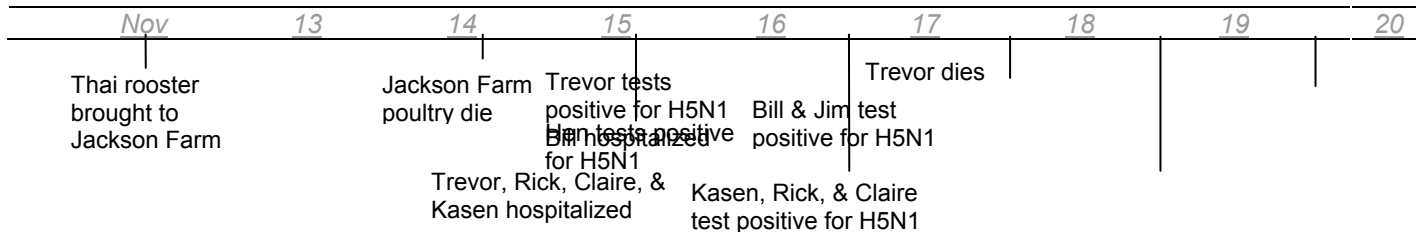
Low-risk exposure groups are currently defined as:

- *Health-care workers not in close contact (distance greater than 1m or no direct contact with infectious material) with a strongly suspected or confirmed H5N1 patient*
- *Health-care workers who used appropriate personal protective equipment during exposure to H5N1 patients*
- *Personnel involved in culling non-infected or likely non-infected animal populations to prevent viral spread*
- *Personnel involved in handling sick animals or decontaminating known infected animals or environments, who used proper personal protective equipment.*

In the absence of sustained human-to-human transmission, the general population is currently not considered at risk."

Question 4 – What are the ethical issues that you should consider when deciding to administer antiviral prophylaxis?

Suggested answer – *Consider how to balance rights of the individual versus the obligation to protect the public's health. How can public health officials ensure that discrimination by sex, race, socioeconomic status, religion, ethnicity, sexual orientation, and insurance status does not occur? At the same time, how might other criteria be used to differentiate between groups that should receive prophylaxis? For example, is age an acceptable criterion? What about geography, occupation, or health status? Also, consider the risks and benefits of the antiviral medications themselves.*



S. Investigation - Risk Communication

Instructions:

Read the following update. In your small group, create an appropriate public message.

Time Allotted: 15 minutes

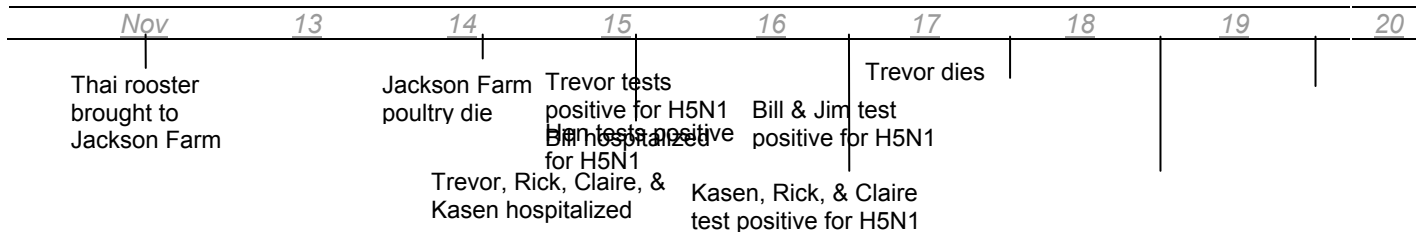
Update 18

It is still Wednesday, November 21st, and it appears as though the outbreak is subsiding. In addition to the 6 previously confirmed cases, contact tracing identified only 1 additional suspect case. This morning the laboratory reported that specimens from the suspect case tested negative for influenza and were actually identified as a rhinovirus (cause of the common cold). Trevor Jackson has died, and Kasen Punyawong remains hospitalized in critical condition. This morning you received Abby Crawford's laboratory results, which were negative for H5N1 but positive for influenza A (H1), seasonal influenza A virus infection.

Although you suspect that the outbreak has been contained, you would like to develop a message to the public that addresses basic infection control. Your office has been swamped with phone calls about whether it is safe to eat turkey. Since the Thanksgiving holiday is tomorrow, you would like to craft a message specifically about food safety.

Question 1 – What message should the public information officer on a joint Agriculture and Public Health task force disseminate to the public about basic infection control?

Suggested answer – *The message should address hand-washing, the lack of human-to-human transmission in the current H5N1 human outbreak (therefore meaning that PPE is not necessary), and the fact that people can avoid risk by not having contact with ill poultry. It may be wise to address a separate message to poultry farmers and workers advising them about proper use of PPE and awareness of signs and symptoms of HPAI H5N1 in both birds and humans.*

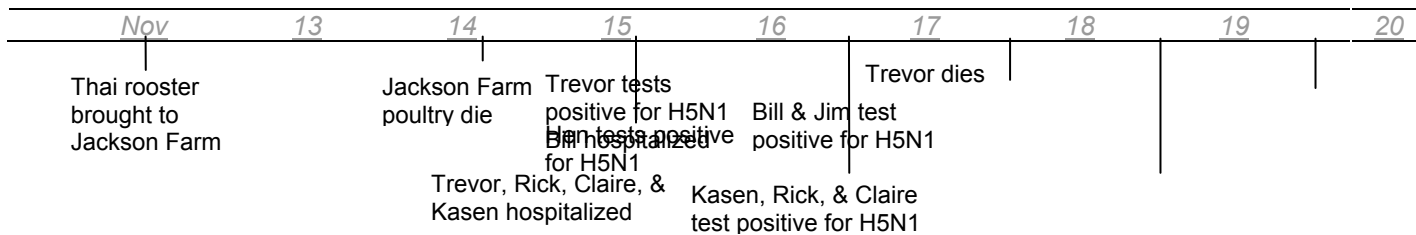


Question 2 – What message would you disseminate to the public about food safety, especially during the Thanksgiving holiday?

Suggested answer – *Eating properly cooked poultry is safe, but provide people with the minimum temperature and length of time that they should cook their turkeys (adjusted for size), and proper procedures for storing the leftover turkey. Emphasize that there are important precautions for handling, preparing, cooking and eating poultry. The effectiveness of handwashing should be a key message. Ideally, these messages would have been disseminated from the start of the outbreak.*

Question 3 – Are there populations in your area that might not receive media messages because of language, cultural, or other barriers? How could you ensure that public health messages are communicated to these populations?

Suggested answer – *Answers will vary depending on the local area, but some examples of populations that might not receive public health messages are: people in institutions (nursing homes, prisons, etc), homeless people, people who do not speak English, migrant farm workers, and people with disabilities. Communicating with these groups ideally would involve identifying and working with them prior to an emergency event. Participants should be encouraged to identify organizations that represent these groups that could be partners in emergency planning.*



T. Conclusion

Update 19

Today is November 29, 2007, a week after Thanksgiving. The National Veterinary Services Laboratory has confirmed that the H5N1 strain of avian influenza from Jackson Farm poultry was highly-pathogenic, confirming results obtained from human clinical specimens. Below is a summary of what you know about each confirmed or suspect case.

Trevor Jackson - died
 Kasen Punyawong - died
 Rick Jackson –still hospitalized, in stable condition
 Heidi and Lisa Jackson – no symptoms
 Claire Jackson – recovering in hospital
 Bill Zalesky – still hospitalized, in critical condition
 Pravat Punyawong (Kasen’s brother) – no symptoms
 Jim Baxter – recovering in hospital
 Shana Patel – negative for H5N1, positive for seasonal influenza A (H1)
 Abby Crawford – negative for H5N1, positive for seasonal influenza A (H1)

The Department of Agriculture discovered that the fighting cock died on Wednesday, November 14, 2007, and Kasen buried the bird behind his uncle’s house. They have exhumed the bird for laboratory tests and examination, and have disinfected the premises. The Jackson family is being compensated for the loss of their poultry flock. The community reaction has lessened somewhat, and it appears as though your messages emphasizing the absence of human-to-human transmission have calmed people’s fears. You still have a lot of paperwork to fill out, and CDC and local team members are assisting you with follow-up studies, but you hope that you’ll be able to get back to your other responsibilities in the next week or so.

U. Evaluation

Instructions:

Read the following update. While the experience of working through this scenario is fresh in your mind, answer the questions that follow individually, and then discuss responses with your small group. Have one group member record common themes to share with the larger group.

Time Allotted: 25 minutes

Update 20

It is now December 7, 2007, three weeks after the initial human cases of avian influenza in your area. You are exhausted, but take comfort in knowing that the quick and decisive action of your rapid response team probably was a significant factor in limiting the spread of the outbreak. There were a total of 6 confirmed human cases of HPAI H5N1, but you believe that the outbreak could have been much worse. Your health department continues to work, alongside CDC, to conduct follow-up interviews of contacts, monitor cases, and communicate with the public and other agencies.

Facilitator – *Encourage the group to discuss these questions openly, and to identify areas in which their response could be improved. If there are specific aspects of the response that were particularly good (or bad), you may want to provide your own feedback (as an observer) to the group.*

Question 1: On a scale of 1 (poor) to 10 (excellent), please rate your group's response to the outbreak. Discuss your rating (considering which aspects of the response worked the best, and which aspects could be improved).

Question 2: What was the most important thing that you learned during the outbreak?

Question 3: Was there anything that surprised you during the outbreak?

Question 4: In what ways would your response to avian influenza in humans differ markedly if the disease was introduced via an international traveler rather than in domestic poultry?

Question 5: Based on this exercise, what is the next step that you will take to make sure that your agency is better prepared for an avian influenza outbreak?

Final Instructions

Share key pieces of feedback with the larger group. Focus on lessons learned and next steps.

Appendix A Case Study: Generic Outbreak Reporting Questionnaire

(from CDC Guidance for State and Local Health Departments for Conducting Investigations of Human Illness Associated with Domestic Highly Pathogenic Avian Influenza Outbreaks in Animals)

This questionnaire is based on a questionnaire developed by the Fraser Health Authority, British Columbia, Canada for use in the 2004 HPAI avian influenza outbreak in British Columbia. Fields where specific information has to be included have been identified (with < > brackets) to make this form easy to adapt at the time of an avian influenza outbreak. It is expected that this will be a useful tool for any state/local health department faced with an avian influenza outbreak in the future.

Avian Influenza in _____
<outbreak State/location>

Avian Influenza Surveillance Report Form

When completed, please fax to the attention of:

_____ <contact person and fax number>

{Suggested Opening Script}

Hello. My name is: _____. I am a public health nurse from _____
<health department>.

As part of our duties under the _____ <cite state authority> we are following up with people who may have been exposed to avian influenza, otherwise known as bird flu. The avian influenza virus currently causing outbreaks among poultry in _____ <outbreak area> may have caused some illness in people who have had contact with infected birds or people. This form of influenza virus has rarely been known to cause illness in humans, but when it does, the illness can be severe. For this reason, it is very important that we collect detailed information about this outbreak and any possible illness in people.

All identifying information that is collected will be kept private and confidential to the extent permitted by law and shared only with public health officials who need to know in order to understand and provide treatment to anyone who may need it. Depending on the information we collect, this may take up to 20 minutes. Is this a good time to talk? If not, when would be a better time? _____

[If the interview not proceeding well, ask] Is there someone else that I should speak to instead in your home (or farm, etc.) related to this outbreak? If so, whom?
_____/_____/_____ <name/relationship>

Please use the back of the page for additional notes, including commentary on relevant details and dates (e.g., direct exposures, incidents, personal protection equipment, etc.).

Section I. Health Department Information

Date of report (mm/dd/yyyy): ____/____/____

Contact Information:

Name of person administering questionnaire: _____

Name of state/local health department: _____

Phone no. of health department: _____

This report is ☐ NEW ☐ UPDATE

As of this report, this person is classified as a:

☐ Suspect Case

☐ Probable Case

☐ Confirmed Case

☐ Person Under Investigation

☐ Contact

Section II. Case Demographic Information

{Identification number (ID#) assigned to interviewee: _____ <format of ID# assignment must be predetermined>}

Last name: _____

First name: _____

Date of Birth (mm/dd/yyyy): ____/____/____

Age: _____ years

Sex: ☐ Male ☐ Female

Home address: _____

Home city: _____

State of residence: _____

Zip code: _____

Phone numbers in state of residence:

Home: _____

Office: _____

Cell: _____

Address while in _____ <outbreak state> if different from
above: _____

Phone Number(s) while in _____ <outbreak state> if different from
above: _____

Planned date of return to state of residence [if applicable] (mm/dd/yyyy):
_____/_____/_____

What is your occupation/industry? _____

Who is your employer? _____

Please indicate appropriate relationship based on occupation/employer:

- ☐ Farm owner
☐ Family member of farm owner
☐ Farm employee
☐ USDA worker
☐ Other (specify): _____

Section III. Case Medical History

1. Do you have a heart or lung condition?

☐ Yes ☐ No ☐ Unknown

If yes to heart or lung conditions, specify:

2. Do you have any other chronic conditions?

☐ Yes ☐ No ☐ Unknown

If yes to any other chronic conditions, specify:

3. Have you been told that you have a weak immune system?

☐ Yes ☐ No ☐ Unknown

If yes to a weak immune system, specify:

4. Do you have a chronic eye condition?

☐ Yes ☐ No ☐ Unknown

If yes to a chronic eye condition, specify:

5. Do you have any allergies?

☐ Yes ☐ No ☐ Unknown

If yes to any allergies, specify:

6. Are you currently a smoker? ☐ Yes ☐ No

If yes:

a. How many packs do you smoke each day?

☐ > 1 pack

☐ > 1 < 3

☐ > 3

b. How many years have you smoked?

☐ 0-2

☐ >2 < 5

☐ >5

7. Have you received influenza vaccination in the last 12 months?.

☐ Yes ☐ No ☐ Unknown

If yes:

Date of vaccination: (mm/dd/yyyy) ____/____/____

Reason for vaccination:

☐ Age over 65

☐ Lung disease (e.g. asthma, emphysema, COPD)

☐ Diabetes

☐ Immune deficiency

☐ At my own request

☐ Because of this avian influenza outbreak after the outbreak occurred

☐ Offered through work before the outbreak occurred

☐ Other (specify) _____

Section IV. Case Clinical Symptoms

2. Have you had any of the following eye symptoms? Check all that apply, but please report only those symptoms that are NEW or WORSE since the outbreak began:

☐ Red eye(s)	Circle:	One eye	Both eyes
☐ Teary eye(s)	Circle:	One eye	Both eyes
☐ Burning eye(s)	Circle:	One eye	Both eyes
☐ Painful eye(s)	Circle:	One eye	Both eyes
☐ Itching eye(s)	Circle:	One eye	Both eyes
☐ Pus in eye(s)	Circle:	One eye	Both eyes

☐ Sensitivity to light Circle: One eye Both eyes

If one or more of the boxes above is checked, please answer the following:

a. When did the first of these symptoms begin (mm/dd/yyyy)?

____/____/____

b. How would you rate these symptoms?

☐ Mild ☐ Moderate ☐ Severe ☐ Unknown

c. How quickly did these symptoms start:

☐ Suddenly ☐ Gradually ☐ Unknown

2. Have any of the following influenza-like symptoms started or become worse than usual since ____/____/____ <date of outbreak onset (mm/dd/yyyy)>?
(Check all that apply, but please report only those symptoms that are NEW or WORSE since the outbreak began):

- ☐ Fever
☐ Temperature: _____ °F
☐ Cough
☐ Runny nose
☐ Sore throat
☐ Headache
☐ Muscle aches
☐ Joint Aches
☐ Fatigue
☐ Diarrhea
☐ Chills
☐ Sweats

If yes, please answer the following:

a. When did the first of these symptoms begin (mm/dd/yyyy)?

____/____/____

b. How would you rate these symptoms?

☐ Mild ☐ Moderate ☐ Severe ☐ Unknown

c. How quickly did these symptoms start:

☐ Suddenly ☐ Gradually ☐ Unknown

3. Did you have any other symptoms that started or became worse than usual since ____/____/____ <date of outbreak onset (mm/dd/yyyy)>?

☐ Yes ☐ No ☐ Unknown

If yes, please answer the following:

a. Describe these symptoms: _____

b. How would you rate these symptoms?

☐ Mild ☐ Moderate ☐ Severe ☐ Unknown

c. How quickly did these symptoms start:

☐ Suddenly ☐ Gradually ☐ Unknown

d. When did the first of these symptoms begin (mm/dd/yyyy)?

____/____/____

Section V. Case Health Care Provision

1. Did you see a healthcare provider for your symptoms? ☐

Yes ☐ No ☐ Unknown

If yes, please respond to the following:

- a. What type of healthcare provider did you see?

☐ Physician

If yes, was he/she a ☐ general practitioner or a ☐ specialist?

☐ Nurse practitioner

☐ Physician assistant

☐ Other, specify: _____

- b. What was the diagnosis? _____

- c. What is the healthcare provider's name? _____

- d. What is the healthcare provider's address? _____

- e. What is the healthcare provider's phone number?

2. Where did you seek medical assistance for your symptoms?

☐ Hospital emergency department

☐ Walk-in clinic

☐ Health center

☐ Occupational health clinic

☐ Other; please specify: _____

Please provide the name and location: _____

When did you seek medical care (mm/dd/yyyy)? ____/____/____

3. Were you hospitalized for these symptoms?

☐ Yes ☐ No ☐ Unknown

If yes, please provide name and location: _____

If yes:

Date of admission (mm/dd/yyyy) ____/____/____

Date of discharge (mm/dd/yyyy) ____/____/____

4. Did you have a chest X-ray taken because of these symptoms?

☐ Yes ☐ No ☐ Unknown

If yes:

Please provide name and location where X-ray was taken:

Date X-ray taken (mm/dd/yyyy) ____/____/____

X-ray result if known:

5. Did you have any other laboratory tests done? {Check all that apply}

☐ Yes ☐ No ☐ Unknown

If yes:

☐ Swab from the nose Date(mm/dd/yyyy) ____/____/____

☐ Swab from the eye Date(mm/dd/yyyy) ____/____/____

☐ Blood sample Date(mm/dd/yyyy) ____/____/____

☐ Other (specify) _____ Date(mm/dd/yyyy) ____/____/____

6. How are you feeling today?

☐ Same symptoms since onset

☐ Better than at onset

☐ Worse than at onset

☐ Completely recovered

If recovered, what was the first day that you no longer had any symptoms?

(mm/dd/yyyy) ____/____/____

7. Have you taken antiviral medications (e.g., Tamiflu/oseltamivir or Relenza/zanamivir) since <date of outbreak onset>?

☐ Yes ☐ No ☐ Unknown

If yes, reason for medication:

☐ Treatment for influenza symptoms

☐ Preventative measure due to exposure to poultry

☐ Other (specify) _____

Specify name of medication (e.g. Tamiflu/oseltamivir or Relenza/zanamivir):

How many capsules or inhalations did you take each day?

Medication start date: (mm/dd/yyyy) ____/____/____

Medication stop date: (mm/dd/yyyy) ____/____/____

Section VI. Case Exposure to Avian Influenza Information

1. Since <date of outbreak onset> have you had contact with poultry, poultry products, or poultry manure?

☐ Yes ☐ No ☐ Unknown

If yes, when was your first contact/exposure? (mm/dd/yyyy) ____/____/____

When was your last contact/exposure? (mm/dd/yyyy) ____/____/____

2. Do any of these statements apply to you (check all that apply)?

- ☐ I own a poultry farm
☐ I live on a poultry farm
☐ I am a family member or household contact of a poultry farmer
☐ I am employed by a poultry farm
☐ I am a veterinarian
☐ I have been helping cull poultry
☐ I have been transporting poultry carcasses
☐ I have been working at an incinerator
☐ Other (specify): _____

3. What poultry farm(s) have you visited or worked on since <date of outbreak onset>?

Farm 1 Name and address _____

Farm 2 Name and address _____

Farm 3 Name and address _____

{Section below to be completed by public health staff with information from USDA or State Agriculture officials}

Farm 1:

Name of farm: _____

Was this farm the site of laboratory-confirmed avian influenza outbreaks in poultry?

☐ Yes ☐ No ☐ Unknown

Location on farm where poultry infections occurred: _____

Date Positive(mm/dd/yyyy)

Date Culled(mm/dd/yyyy)

Date Clean(mm/dd/yyyy)

Farm 2:

Name of farm: _____

Was these farm the site of laboratory-confirmed avian influenza outbreaks in poultry?

☐ Yes ☐ No ☐ Unknown

Location on farm where poultry infections occurred: _____

Date Positive(mm/dd/yyyy)

Date Culled(mm/dd/yyyy)

Date Clean(mm/dd/yyyy)

Farm 2:

Name of farm: _____

Was this farm the site of laboratory-confirmed avian influenza outbreaks in poultry?

☐ Yes ☐ No ☐ Unknown

Location on farm where poultry infections occurred: _____

Date Positive(mm/dd/yyyy)

Date Culled(mm/dd/yyyy)

Date Clean(mm/dd/yyyy)

4. Have you participated in any of the following activities at these farms? Please identify next to each activity the farm number in Q 3 above for each farm or farms where you undertook these activities.

☐ I have not been directly involved with poultry

☐ I worked at an incinerator

☐ I worked in a slaughterhouse

☐ I brought equipment to farms (e.g. equipment to gas flocks)

☐ I worked with carbon dioxide gas to euthanize the birds

☐ I collected eggs

☐ I was in direct contact with surfaces that may have been contaminated by poultry

☐ I was in direct contact with manure from the poultry

☐ I shared a confined air space with infected or potentially infected poultry

☐ I assessed the health of poultry.

☐ I caught live poultry

☐ I had other contact with live poultry (specify) _____

☐ I collected dead poultry.

☐ I had other contact with dead poultry (specify) _____

☐ I loaded / unloaded poultry carcasses into / out of trucks

☐ Other (please specify): _____

5. Do you wash your hands after such exposure/activities?

☐ Yes ☐ No ☐ Unknown

If yes how often do you wash your hands after exposure?

- ☐ 100% of the time ☐ 75-100% of the time ☐ 50-75% of the time
☐ 25-50% of the time ☐ less than 25% of the time ☐ Unknown

6. If you have been exposed to potentially infected poultry, were you wearing any of the following while you were exposed? *{check all that apply}*

- ☐ Gloves
☐ Mask (Type _____).
☐ Goggles
☐ Safety glasses
☐ Impermeable Coveralls
☐ Disposable shoes or shoe covers
☐ Head and hair cover
☐ Disposable Outer garments
☐ Boots that can be cleaned and disinfected after exposure and worn again
☐ Outer garments that can be washed and worn again

7. Can you remember any events of concern in terms of exposure? Please describe. Please keep in mind that all of this information will be kept confidential to the extent permitted by law *{use additional space if necessary}*.

8. Have you had close contact with a person who lives/works on a poultry farm since <date of outbreak> and who has/had respiratory or eye symptoms? By close contact, we mean family members, roommates, intimate partners, etc.

- ☐ Yes ☐ No ☐ Unknown

If yes, who (and relationship to you)?

If yes, date of your first exposure to this person (mm/dd/yyyy): ____/____/____
Date of your last exposure to this person (mm/dd/yyyy): ____/____/____

Section VII. Contacts

1. How many other people live in your household not including yourself?
- ☐ None
☐ 1-3
☐ 3-5
☐ >5

2. In your household are there any people in the following categories? {check all that apply}

- ☐ Child <10 years of age
- ☐ Elderly person >70 years of age
- ☐ Pregnant woman
- ☐ Person receiving chemotherapy
- ☐ Person who is HIV positive

2. Besides the people living in your household, with how many other people do you have close personal contact on a daily basis? This may include, for example, other family members not living in the home, intimate partners, or co-workers.

- ☐ 0
- ☐ 1-3
- ☐ 3-5
- ☐ >5

3. Have any of your household members or other personal close contacts experienced any of the symptoms that were mentioned earlier since <date of outbreak>?

- ☐ Yes ☐ No ☐ Unknown

If yes, please provide the following information for these people:

Name of Contact No. 1:

Their relationship to you:

Dates of contact with this person (mm/dd/yyyy):

- ☐ Single day only ____/____/____
☐ Multiple days ____/____/____ ____/____/____ ____/____/____
☐ Continuous contact from ____/____/____ to ____/____/____

Contact telephone number: _____

Contact address:

Name of Contact No. 2:

Their relationship to you:

Dates of contact with this person (mm/dd/yyyy):

- ☐ Single day only ____/____/____
☐ Multiple days ____/____/____ ____/____/____ ____/____/____

☐ Continuous contact from ____/____/____ to ____/____/____

Contact telephone number: _____

Contact address:

Name of Contact No. 3:

Their relationship to you:

Dates of contact with this person (mm/dd/yyyy):

☐ Single day only ____/____/____

☐ Multiple days ____/____/____ ____/____/____ ____/____/____

☐ Continuous contact from ____/____/____ to ____/____/____

Contact telephone number: _____

Contact address:

{For public health department completion}:

Could the illness in these contacts possibly have resulted from person-to-person transmission? ☐ Yes ☐ No ☐ Unknown

Please explain the circumstances:

Section VIII. Other People Exposed

If exposed at a farm: Have any other people had close contact with infected birds at the same farm as yourself, including direct handling of birds or manure or shared the same confined airspace as infected birds?

☐ Yes ☐ No ☐ Unknown

If yes, how many people? _____

If yes, what are their names and telephone numbers?

1. Name _____ Tel. No. _____

2.Name_____Tel. No._____

3.Name_____Tel. No._____

{Suggested Closing Script}

Thank you very much for taking the time to answer our questions. There may be other questions we need to ask you as part of our public health follow-up, and, if so, we may call you back. You are also free to call us anytime if you have any questions. The _____<state/local> Health Department's telephone number is _____ and our hours of operation are _____ AM to _____ PM.

{Note to Interviewer}: *Conclude with relevant public health recommendations and offer to send the "Dear Poultry Farmer" letter or other information, if appropriate and not already received.*