Special Report

A federal and state transport plan for movement of eggs and egg products from commercial egg production premises in a high-pathogenicity avian influenza control area

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The FAST Eggs Plan is a voluntary plan for commercial egg producers intended to facilitate business continuity following an outbreak of HPAI. Participation in the FAST Eggs Plan will reduce the time required for regulatory officials to determine that it is safe for eggs and egg products from noninfected chickens located within a control area to move into market channels located outside the control area. The FAST Eggs Plan has 5 components. First, a Biosecurity Checklist for Egg Production Premises and Auditors includes biosecurity measures that will help prevent introduction of avian influenza virus onto egg-production premises. Second, registration with the National Animal Identification System is required for participating egg-production premises, and the premises location is verified by GPS coordinates. Third, epidemiological data are used to determine whether an egg farm has been exposed directly or indirectly to birds and other animals, products, materials, people, or aerosols from premises on which HPAI virus has been confirmed. Fourth, the absence of HPAI virus on FAST Eggs Plan premises is verified by negative RRT-PCR assay results from a minimum of 5 dead chickens selected from those that die each day from each house on the farm. Fifth, the risk of exposure to HPAI virus is estimated by use of an equation based on risks not mitigated by quarantine and distance from infected premises.

In Hong Kong in 1997, an H5N1 HPAI virus was transmitted directly to humans from chickens, resulting in 18 human infections and 6 human deaths.[1] All genes in that virus were of avian origin, and avian influenza was recognized as a potentially zoonotic disease.[2] Descendants of this particular H5N1 virus continued to circulate in Asia, and a major outbreak in chickens occurred in South Korea in December 2003. In January and February 2004, the disease was reported in Vietnam, Japan, and 5 other Asian countries.[3]

Abbreviations	
FAST	Federal and State Transport
GPS	Global positioning system
GRE	Geospatial risk estimate
HPAI	High-pathogenicity avian influenza
NAIS	National Animal Identification System
RRT	Real-time reverse transcriptase

High-pathogenicity avian influenza was confined to Asia until a tipping point in the geographic spread of H5N1 HPAI occurred in April 2005. At that time, a high mortality rate was reported in migratory waterfowl on Qinghai Lake in northern China,[4] and migration patterns of geese, gulls, and cormorants on that lake extend to and include other locations in Asia, the Middle East, Africa, and Europe.[5] During the summer and fall of 2005, the H5N1 virus spread westward from China across Mongolia and Siberia to the Ural Mountains of Russia, to Kazakhstan, and eventually to Romania and Turkey. By the end of 2006, the H5N1 virus had spread to India and Bangladesh, Israel, Nigeria, Egypt, Niger, Cameroon, and additional countries in Europe.[3] Since December 2003, more than 250 million poultry have been killed through slaughter eradication programs or by the H5N1 virus. In addition to birds and humans, the H5N1 virus has infected domestic cats, tigers, leopards, dogs, and swine.[6]

The H5N1 virus represents a continuing threat to the poultry industry, public health, and food security in the United States. This virus could enter the United States via smuggled live birds (psittacines and fighting game birds) or smuggled poultry products.[7,8] It could also enter via migratory waterfowl (birds of the orders Anseriformes or Charadriiformes) from Asia, which share summer breeding grounds in Alaska with migratory waterfowl from the North American continent.[9] In April 2006, an early detection system for H5N1 HPAI in wild migratory birds was initiated by the USDA, the US Department of the Interior, and the US Fish and Wild-

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life Service. Employees with the US Geological Survey in Alaska continue to monitor migrating birds for the presence of H5N1 virus, and as of October 2009, none has been detected.[10] As a primary safeguard, the USDA maintains trade restrictions on the importation of live poultry or poultry products from countries in which the H5N1 HPAI virus has been identified in commercial or traditionally raised poultry.[11] In addition, the USDA's Smuggling Intervention and Trade Compliance unit has increased its monitoring of domestic commercial markets for illegally smuggled poultry and poultry products. All imported live birds from countries other than Canada must be quarantined for 30 days at a USDA quarantine facility and tested for avian influenza virus of any strain before entering the country.

Sources of Avian Influenza Virus

The most important sources of avian influenza virus include contaminated poultry manure, respiratory secretions, live poultry, dead poultry, unwashed eggs, and reused packing materials.[12] High-pathogenicity avian influenza viruses are shed in feces and in nasal and respiratory tract secretions and are transmitted via ingestion of contaminated feces or inhalation of aerosolized dust or respiratory droplets.[13] Contamination of feed, water, or litter leads to rapid spread within a poultry house. Eggs laid 3 to 4 days after infection of chickens by an HPAI virus can contain virus,[13] but vertical transmission of HPAI virus to chicks via this route has not been reported.

Spread of avian influenza viruses from an infected index flock of domesticated poultry to other susceptible poultry is usually a result of human activity.[12,13] Movement of infected birds or contaminated manure to other locations is a common mechanism of disease transmission.[14] In addition, movement of people, equipment, and vehicles contaminated by virus-laden feces or respiratory secretions can mechanically carry the virus to other premises. People moving between poultry premises include truck drivers hauling feed to farms, spent hens to processing plants, or dead birds to rendering plants; utility (electricity and water) company workers; vaccination, beak trimming, and hen-catching crews; and individuals providing management and health services.[12] Shared equipment that may move from one farm to another includes items used for manure handling, bird catching and transport (portable coops and crates), vaccination, beak trimming, and egg transport.[12] In addition, vehicles such as tractors, automobiles, and trucks can carry people and equipment between chicken-rearing sites, egg-production sites, and various nonfarm sites.

National HPAI Response Plan and Control Areas

In response to the threat posed by H5N1 HPAI virus, a National Highly Pathogenic Avian Influenza Response Plan was developed by the USDA APHIS in cooperation with the nation's poultry industry and other stakeholders. A summary of the plan was initially published in April 2006, with amended versions appearing in August 2006 and August 2007.[15] This contingency plan provides USDA APHIS operational guidelines for the unified state and federal animal health official emergency response should HPAI be detected in domestic poultry in the United States. Roles and responsibilities, quarantine and movement controls, and procedures for appraisal and compensation, euthanasia, disposal, cleaning and disinfection, biosecurity, and wildlife management are described and defined. In addition, the response plan provides for the stockpiling and use of personal protective equipment for those involved in the emergency response.

In the event of an outbreak of HPAI, state and federal regulatory officials would immediately establish, at a minimum, an infected zone within a 2.0-mile (3-km) radius around infected premises and a buffer zone, which would immediately surround the infected zone and extend outward to a 6.2-mile (10-km) radius around the infected premises (**Figure 1**). The control area would consist of the infected zone and the buffer zone; movement of susceptible species, potentially contaminated transport vehicles, and potentially contaminated animal products into and out of the control area would be restricted by state and federal animal health officials to prevent further spread of the virus. Within 96 hours after identifying the index case, the nature of the outbreak would be characterized, epidemiological links to other premises would be identified, and mitigation strategies would be developed.

The national response plan continues to evolve on the basis of ongoing feedback from state animal health officials, the poultry industry, and the availability of new scientific information about avian influenza. The goal of the national response plan is to contain and eradicate

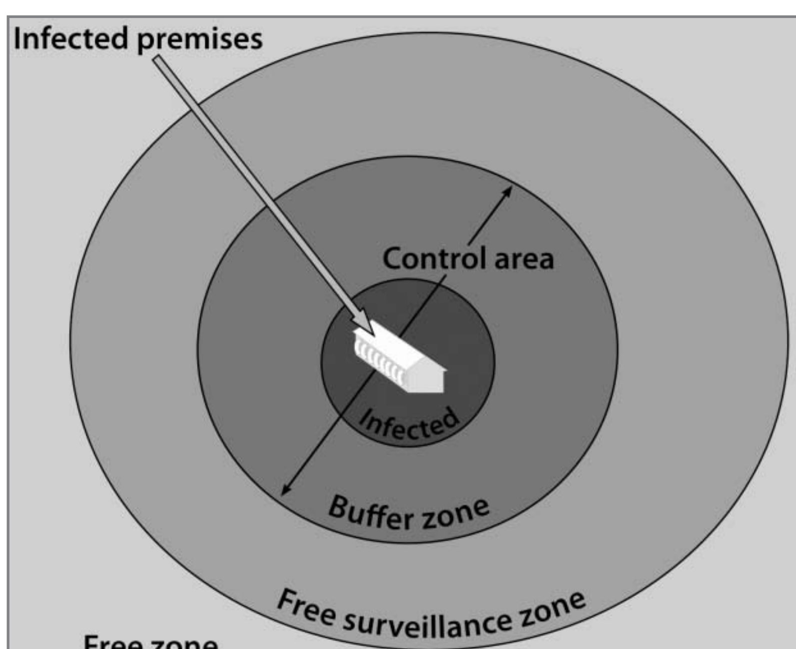

Figure 1—Diagram of HPAI response zones in the US National HPAI Response Plan.

HPAI virus in domestic poultry by integrating the capabilities and resources of the federal government, states, tribal nations, local communities, and private organizations. An additional goal, and potential competing interest, is the continuity of business for egg production in which quarantine orders are based on actual biosecurity conditions, epidemiological threats, and actual diagnostic results and not on political boundaries or geospatial considerations alone.

Business Continuity in Control Areas

Business continuity will be a challenge for owners of noninfected commercial table-egg premises in a control area. Movement of eggs and egg products in such areas may be restricted for at least 96 hours, which could be economically disastrous for large, modern egg-production operations. A typical modern in-line egg-production facility in the United States contains 1.5 to 4.0 million laying hens of varying ages. Assuming a 75% mean laying rate and eggs priced at $1.00/dozen, 1.13 to 3.0 million eggs are produced each day with a market value of $94,166 to $250,000. Maximum egg-storage capacity at most egg-production premises is limited to the number of eggs produced during a 48-hour period. If transport of eggs and egg products is delayed for > 48 hours, all eggs produced thereafter must be destroyed.

Of even more importance is the fact that today's egg industry operates on a "just-in-time" basis. Each day, eggs move from production sites to food service distributors, retail stores, and distribution centers owned by fast-food restaurants and grocery store chains. If an egg operation in a control area cannot move eggs or egg products into market channels, many of its customers will exhaust their supply of eggs in 24 to 48 hours and be forced to look for an alternative supplier. Consequently, the greatest economic impact on individual egg producers in a control area may be the loss of customers, which is a loss that could be permanent and economically fatal to the business.

FAST Eggs Plan

Creation of a plan to facilitate business continuity by allowing movement of eggs and egg products from noninfected premises within an avian influenza control area was the objective of a cooperative agreement between APHIS and faculty at Iowa State University. The result of this work is the Federal and State Transport Plan for Movement of Eggs and Egg Products from Commercial Table Egg Premises in a High-Pathogenicity Avian Influenza Control Area. Components of the plan include the following: minimum biosecurity standards for participating egg premises, location verification with GPS coordinates for egg premises and infected premises in a control area, epidemiological data including a questionnaire to investigate contact with infected premises and flock production variables, an active surveillance program for avian influenza that makes use of RRT-PCR assay testing, and an analysis algorithm that provides a GRE that can be used by incident commanders as a rapid decision-making tool. The FAST Eggs Plan is being developed to promote an appropriate emergency response to HPAI, and if accepted and adopted by state and federal animal health officials and industry stakeholders, it will be incorporated into the national response plan.

Minimum biosecurity standards—Biosecurity is the first and most important means of preventing introduction of avian influenza viruses onto premises.[12,16] The FAST Eggs Plan Biosecurity Checklist for Egg Production Premises and Auditors consists of a list of biosecurity measures that, if fully implemented, will help reduce the risk of introducing HPAI virus onto egg-production premises. Biosecurity measures on this checklist were selected on the basis of extensive input from egg producers, state and federal epidemiologists, and veterinarians employed by the egg industry, universities, and federal regulatory agencies. Voluntarily participating egg-production companies will provide yes or no responses to biosecurity statements on the checklist. Yes means that the biosecurity measure is a company policy, the policy is enforced, and the measure is included in the company's written biosecurity plan. No means that the biosecurity measure is not a company policy and the premises do not qualify for the FAST Eggs Plan until the deficiency is corrected. To participate in the FAST Eggs Plan, staff on egg-production premises must use all core biosecurity measures on the checklist.

An auditor will be assigned to participating egg premises by the State Animal Health Official after consultation with the Federal Area Veterinarian in Charge. An official auditor must be a state or federal animal health official (or another individual) deemed to be qualified and approved by the State Animal Health Official and the Veterinarian in Charge. Auditors will be required to attend USDA-approved training sessions to promote uniformity and objectivity of the audits. Auditors are tasked with confirming the validity of biosecurity statements checked "yes" and submitting a written report of their findings to the State Animal Health Official, the Veterinarian in Charge, and the manager of the egg premises. To protect the biosecurity of the egg operations, auditors will survey the outside areas on the premises and egg-processing areas but will not enter the chicken houses. Data on daily mortality rate, feed consumption, and egg production for each house on egg-production premises will be available to auditors on a computer in the farm manager's office. Auditors can access these data without entering the chicken houses. An approved audit, no more than 6 months old, must be on file with the State Animal Health Official and the Veterinarian in Charge for egg premises to participate in the FAST Eggs Plan. The State Animal Health Official and the Veterinarian in Charge must decide whether the biosecurity level of egg-production premises is sufficient to allow participation (pass) or is not (fail). For premises that fail a biosecurity audit, the reasons for failure will be provided in writing to the farm manager. Farm managers then have the option of taking corrective action and requesting another audit.

Audits are premises specific, and premises may vary in size from a single stand-alone chicken house to multiple chicken houses at a modern in-line egg-production complex. If a company produces eggs at multiple locations, all participating premises must have a separate audit. At least 1 animal health official from each state with participating egg producers will be expected to attend annual USDA-approved training sessions for Egg Premises Auditors to review the clinical signs and lesions associated with avian influenza; discuss interpretation of data pertaining to mortality rate, feed consumption, and egg production; and promote uniformity of audits for the nation's egg industry.

Location verification of FAST Eggs Plan premises with GPS coordinates—Egg-production premises participating in the FAST Eggs Plan will be required to register with the NAIS.[17] The NAIS is a voluntary state-federal-industry partnership that consists of 3 parts: premises identification, animal identification, and tracking of animal movement. Registering premises does not require participation in animal identification and tracking. Longitudinal and latitudinal coordinates for geographic locations of each participating egg operation will be determined by a state or federal employee familiar with the NAIS and trained to use a GPS receiver. Data from the GPS and coordinates of participating commercial premises and nearby backyard flocks will be collected in a format compatible with that used by the USDA Center for Epidemiology and Animal Health in Fort Collins, Colo.[18] A premises identification number will be assigned by the state in which the egg premises are located. Participants may opt to register their premises online or by mailing or faxing forms to their state contact, whose information is provided on the NAIS Web site.[17] Premises registration forms are available on the Web site of each state's Department of Agriculture.

Global positioning system coordinates of poultry premises within a 2-mile (3.2-km) radius of the FAST Eggs Plan premises will also be determined by trained state or federal personnel. State or federal personnel may visit premises and ask residents to voluntarily provide information concerning the presence of domestic birds on their properties. Locations of the FAST Eggs Plan premises and surrounding domestic bird premises will be available to the incident commander at a secure Web site.

Epidemiological data—In the event of an outbreak of HPAI, completion of a questionnaire by managers of participating egg operations will provide epidemiological information that will allow foreign animal disease investigators to determine whether the FAST Eggs Plan premises have been exposed directly or indirectly to birds and other animals, products, materials, people, or aerosols from the infected premises. Once infected premises have been identified, a premises quarantine will be imposed and domesticated birds will be subject to depopulation and proper disposal. If exposure is deemed to have occurred, the FAST Eggs Plan premises will be classified as contact premises, which are premises with birds or products that, based on epidemiological information and findings of the foreign animal disease investigator, have been potentially exposed to HPAI virus from infected premises.[15] The contact premises will be quarantined and subjected to disease control measures that include diagnostic testing and quarantine. If the contact premises are deemed infected, then mass depopulation and disposal of birds or other susceptible animals will be carried out.

In addition to completing a questionnaire at the start of an incident, staff at participating facilities will be required to submit daily information on feed consumption and egg production for each chicken house on premises and the number of chickens that die in each house. These data will be submitted directly to the Web-based server on a daily basis and will be available to the incident commander during the period when the FAST Eggs Plan premises are in a control area.

Active surveillance program—Absence of H5 or H7 avian influenza virus infection on FAST Eggs Plan premises will be verified by requiring that chickens from each house on a given farm be tested each day by means of the RRT-PCR assay, with negative results.[19,20] In addition, chickens in these flocks must be free of clinical signs of disease and the flocks must have no unexplained increase in mortality rate or decline in egg production or feed consumption.

A minimum of 5 dead chickens from those that died each day or from euthanatized sick birds from each house (flock) will be placed in an approved container (eg, heavy-duty plastic garbage bag) each morning. Each container will be labeled with the farm of origin, house of origin, number of birds found dead in the house that day, and the NAIS premises identification number. Containers will be taken to a designated pick-up point, typically the public road closest to the premises. After oropharyngeal samples have been obtained, farm personnel will dispose of the carcasses in accordance with a biosecure protocol.

A state or federal regulatory official (or another individual authorized by the incident commander) will collect samples from each dead chicken by swabbing the oropharynx. Five oropharyngeal swab specimens will be pooled in a tube containing brain-heart infusion broth. The tubes containing oropharyngeal samples (5 swab specimens/tube) from each house on the premises will be submitted to an authorized state veterinary diagnostic laboratory. The brain-heart infusion broth in each tube submitted will be tested for avian influenza virus genetic material via the RRT-PCR assay procedure. Samples for RRT-PCR assays must be submitted to the laboratory on the same day the sample was collected. Laboratory personnel will perform RRT-PCR assays on these samples immediately upon receipt and electronically send test results to the incident commander by the end of each day. The incident commander will report test results to farm managers of the premises of origin as soon as possible.

Unmitigated risks and proximity—Movement restrictions in effect within a quarantined area will mitigate many of the risks associated with transmission of avian influenza virus. Movement of live and dead poultry, manure, eggs and egg products, poultry meat, egg packing materials, and equipment from infected premises will be prohibited. Entry of vendors, pullet trucks, liquid egg transports, shell egg trucks, and other nonessential vehicles will be prohibited. Movement of vaccination crews, loading crews, manure haulers, utility company employees, pest control personnel, and other nonessential people will be curtailed as well. However, risks associated with the following 8 factors (R_1 through R_8) cannot be completely mitigated by movement restrictions associated with a quarantine.

Number of poultry on infected premises (R_1)

The number of infected animals is a major determinant of the distance at which susceptible animals are at risk of infection from infected animals.[21] The size of the viral reservoir is proportional to the number of poultry infected and the quantity of contaminated fecal material produced after the onset of infection.[22] For regulatory purposes, all poultry on premises with HPAI are treated as if they were infected. Avian influenza viruses may retain infectivity for at least 19 days in manure from specific pathogen–free chickens at 15° to 20°C (59° to 68°F).[23]

Production system of the infected premises and the FAST eggs plan premises (R_2)

Poultry in different production systems are physically and functionally separated by management and biosecurity practices so that people and equipment do not move from one system to another. Each of the following 4 types of poultry enterprises represents a different production system: table-egg operations, broiler production, turkey enterprises, and backyard or hobby flocks. Commercial laying hens, broiler chickens, and turkeys are typically hatched in single-species hatcheries, raised indoors in flocks containing thousands of birds on farms dedicated to 1 type of poultry production, and fed carefully formulated feed delivered to the farm in trucks from feed mills. Eggs and meat products enter market channels leading to distribution to multiple states. Each of the production systems is vertically coordinated.[24] In contrast, backyard flocks comprise relatively small numbers of birds, multiple avian species commonly exist outdoors on the same premises, feed is prepared on the premises or purchased in sacks from a feed store or grain elevator, and meat and eggs are consumed by the producer or sold locally. In the United States, backyard poultry flocks have not been associated with avian influenza outbreaks in commercial poultry.[12]

High-pathogenicity avian influenza virus is not likely to spread to a commercial table-egg farm with a preexisting high level of biosecurity and a totally confined population of laying hens if the infected premises belong to a different production system. However, services and personnel shared between egg production premises increase the risk of HPAI transmission. Commercial table-egg operations with different owners may use the same grain elevator to provide feed, hire workers from the same labor pool, use the same rendering service, or receive visits from the same vendors.[25] Different commercial table-egg premises with the same owner may share additional resources such as trucks and equipment used to move pullets from grow sites to multiple egg farms owned by the company. Selected company employees (veterinarians and managers) may travel between different egg-production sites owned by the same company.[12]

Density of premises with susceptible birds around the FAST eggs plan premises (R_3)

Rapid transmission of HPAI virus among contiguous farms has occurred, and farms with susceptible birds located between the infected premises and the FAST Eggs Plan premises may serve as stepping stones for the spread of HPAI.[26] The number of premises containing susceptible avian populations within a 2-mile radius has been used to assess the risks to biosecurity of poultry farms.[27] Epizootic poultry disease transmission has been associated with movement of humans, poultry, wildlife, and motor vehicles within a 2-mile radius of infected premises. Also, the national response plan makes use of a 2-mile radius to define the area of high risk around the infected premises.[15]

Ambient outdoor temperature (R_4)

The stability of avian influenza viruses declines with increasing temperature, so ambient temperatures can greatly influence survival time of this pathogen on mechanical vectors, such as motor-vehicle tires or equipment, and in the environment. Persistence of avian influenza virus in the environment is inversely proportional to environmental temperature.[28] The greater the ambient temperature, the less time that avian influenza virus can remain infective. Avian influenza viruses are susceptible to inactivation by heating and drying but can survive for months in subfreezing conditions during cold winter months.[13] The viruses can survive in fecal material for 30 to 35 days at 4°C (39.2°F) and for 7 days at 20°C (68°F), for up to 72 hours at room temperature (approx 21°C [70°F]) on the surface of tires and eggshells, and for 6 days on feathers.[13,29,30] In an organic substrate, avian influenza viruses can remain viable for 15 days at room temperature.[29] The mean of the high and low outdoor temperature on a given calendar day will be calculated and used to help determine the GRE.

Presence of open water available to wild waterfowl (R_5)

Proximity to open water is a measure of the risk posed by wild waterfowl. Ducks and geese are natural hosts for avian influenza virus and may transfer the virus from one location to another.[13,14] Anyone or anything sharing an environment with waterfowl may be a source of avian influenza virus for domestic poultry. Outbreaks of HPAI in domestic poultry have been associated with bodies of open water located < 0.62 miles (1 km) from the poultry facilities.[31] In fresh water at 16.7°C (62°F), H5N1 HPAI viruses can persist for 3 to 5 months and some low-pathogenic avian influenza H5 and H7 viruses may survive > 1 year.[28] Wind transmission of avian influenza virus–contaminated water droplets or fecal dust from the shore is a risk factor for infection when ponds or lakes near poultry houses have been frequented by infected waterfowl.[14]

Number of wild terrestrial birds on the infected premises (R_6)

Entry of wild birds into poultry buildings is 1 mechanism by which HPAI can be transmitted.[13,14] Wild birds may mechanically transfer contaminated feces from infected poultry to premises with susceptible domestic birds or become infected and disseminate the virus through their own feces and respiratory tract secretions.[8] Sparrows, feral pigeons, crows, and magpies have been infected with H5N1 HPAI virus.[32] A subclinical infection in tree sparrows was detected in China.[32]

Number of outdoor flies on the infected premises (R_7)

Flies have the potential to serve as mechanical carriers of avian influenza virus by transporting contaminated fecal material from infected premises to premises with susceptible poultry. High-pathogenicity avian influenza H5N1 viruses have been detected in flies captured within a radius of 1.4 miles (2.25 km) around infected premises,[33] and wind can carry flies over long distances.

Distance between the infected premises and the FAST eggs plan premises (R_8)

Proximity to infected premises ≤ 0.93 miles (1.50 km) is reportedly a major risk factor for HPAI in individual flocks.[34] The greater the distance from infected premises, the less the probability that viable avian influenza virus will be carried to chickens on an egg farm. Aerosol transmission of avian influenza virus can occur via small contaminated particles that remain suspended in air for prolonged periods. Aerosolized particles can be carried over several miles.[13,14,35] High-pathogenicity avian influenza viruses have been detected in air samples collected up to 45 m away from chicken houses.[30] Wind-blown feathers from poultry infected with HPAI virus are potentially infectious because of viral replication within the feathers and contamination of the feathers with fecal material from infected birds.[36] Greater distances between infected premises and premises with susceptible birds allow more time for desiccation and UV light to inactivate avian influenza viruses associated with dust or feathers.

GRE—An equation was developed to estimate the risk of exposure to HPAI virus in a control area on the basis of total exposure risks not mitigated by a quarantine and the distance between the infected premises and egg premises participating in the FAST Eggs Plan. By dividing total unmitigated risk by proximity, a numeric GRE can be obtained to provide a quantitative assessment of the exposure risk.[22] To develop the equation, the importance of each risk factor was determined by a panel of 10 poultry veterinarians. Panel members scored each risk factor on a scale from 1 (least important) to 4 (most important).

In the equation developed for the GRE, numeric multiplication factors are used to represent the importance assigned to each unmitigated risk factor by the panel **(Table 1)**. The magnitude of each risk varies with circumstances associated with particular outbreaks and is expressed by a numeric value that may range from 0 (nonexistent risk) to 3 (severe risk). The proximity factor is expressed as the distance (miles) between infected premises and FAST Eggs Plan premises. Values for 6 of 8 unmitigated risk factors in the equation are objective values readily available to a foreign animal disease investigator. Only 2 values (number of wild terrestrial birds and flies at the infected premises) require an estimate by the investigator.

Geospatial risk estimates within a control area may range from 1.8 for egg-production sites located 6.2 miles (9.98 km) from infected premises to 540 for premises located 0.1 mile (0.16 km) from infected premises. We propose that an estimate ≤ 25 represents a low risk of exposure, an estimate of 26 to 74 represents an intermediate risk of exposure, and an estimate ≥ 75 represents a high risk of exposure. The value is calculated with the following formula:

$$\text{GRE} = (\text{total unmitigated risk score/proximity to infected premises}) = (3R_1\,[\text{chickens}] + 3R_2\,[\text{production system}] + 3R_3\,[\text{density}] + 3R_4\,[\text{temperature}] + 2R_5\,[\text{water}] + 2R_6\,[\text{birds}] + 2R_7\,[\text{flies}])/R_8\,(\text{distance})$$

Table 1—Summary of unmitigated risks of exposure to avian influenza virus in a control area used in an equation for GRE in the FAST Eggs Plan.

		Risk magnitude			
Risk	**Risk importance**	**0**	**1**	**2**	**3**
No. of poultry on IP (R_1)*	3	—	≤ 999	1,000–9,999	≥ 10,000
Production system (R_2)	3	—	Not a commercial egg farm	Egg farm, different owner	Egg farm, same owner
Density of premises (R_3)†	3	None	1–3	4–6	≥ 7
Mean temperature (°C; R_4)‡	3	—	≥ 22.8	0.1–22.27	≤ 0
Open water on or near premises (R_5)§	2	None	On or near egg farm, not IP	On or near IP, not egg farm	On or near IP and egg farm
Wild birds on IP (R_6)‖	2	—	Few	Moderate	Many
Outdoor flies on IP (R_7)¶	2	None	Few	Moderate	Many

Risk importance scores represent the degree of importance assigned by a panel of 10 poultry veterinarians with expertise in egg production and avian influenza: 1 = minor importance; 2 = potentially important; 3 = important; and 4 = very important. Risk magnitude scores range from 0 (nonexistent risk) to 3 (severe risk) and vary with circumstances associated with particular outbreaks.

*Flock sizes based on the 2007 Small Enterprise Chicken Study of the National Animal Health Monitoring System.[37] †Number of premises containing susceptible avian populations within a 2-mile (3.2-km) radius of the FAST Eggs Plan premises. ‡Mean temperature (high temperature + low temperature/2) at the official weather reporting station nearest to the infected premises. §Near refers to open water within 0.62 miles of premises. ‖Few is defined as ≤ 100 wild birds (wild birds in the area, but not many). Moderate is defined as 101 to 1,000 wild birds (many wild birds roosting and flying overhead). Many is defined as > 1,000 wild birds (numerous flocks in the area, with many birds roosting on the premises). ¶None is defined as no flies apparent (eg, during subfreezing temperatures). Few is defined as flies observed, but no fly concentrations apparent. Moderate is defined as localized fly concentrations apparent. Many is defined as widely disseminated fly concentrations and surfaces covered with flies observed.

IP = Infected premises. — = Not applicable.

The following hypothetical scenario illustrates how this estimate can be used by an incident commander. An outbreak of HPAI is confirmed in a typical commercial in-line egg operation containing 3.2 million chickens in 16 houses. The outbreak occurs in late November when the mean outdoor temperature is 2.2°C (36°F). Only a few flies are present outside the buildings, and 200 to 300 sparrows and grackles are observed eating spilled grain on the ground near feed bins on the infected premises. In this scenario, the infected premises and noninfected FAST Eggs Plan premises owned by the same company are 1.2 miles (1.93 km) apart, and both premises have on-site egg-breaking operations that require open-water lagoons that are available to waterfowl. In addition, a turkey farm, a ring-necked pheasant farm, and 3 backyard poultry flocks are located within a 2-mile radius of the FAST Eggs Plan premises. The GRE in this scenario is calculated as follows:

$$\mathrm{GRE} = (3[3] + 3[3] + 3[2] + 3[2] + 2\,[3] + 2[2] + 2[1])/1.2 = 35$$

The GRE score of 35 indicates that the FAST Egg Plan premises' risk of exposure to HPAI virus is intermediate. If the distance between the 2 premises had been ≥ 1.7 miles (2.74 km) or if the infected premises had been a small backyard flock, the GRE would have been 25, which suggests that the FAST Eggs Plan premises is at low risk for exposure to the HPAI virus.

Web-based Information

Data from the Biosecurity Checklist, GPS coordinates of FAST Eggs Plan and surrounding premises, responses from the epidemiological questionnaire, PCR assay results, and GREs will be stored in each state's database. These data can be accessed online, but only by authorized individuals. If a state is unable or does not wish to store the FAST Eggs Plan information, the data may be stored in a database maintained by Iowa State University's Center for Food Security and Public Health. Each registered egg producer will have a unique identifier and password with which to log in to the database and enter their appropriate farm information. The farm information will be highly encrypted and only viewable to the logged-in producer. In the event of an outbreak of HPAI, if an owner of registered FAST Eggs Plan premises wants to move eggs or egg products from a control area, it will be the responsibility of the egg producer to release their farm-specific information within the system to the surveillance-epidemiology personnel reporting to the incident commander.

The Web-based approach for this data collection system is practical because it only requires access to the World Wide Web and can be updated instantaneously. Internet communications with the server are kept to a minimum, and the program fully functions even with a slow dial-up connection. Other than a Web browser, no special software programs are needed to access the database. If an update is made in the database, registrants will immediately have access to that update. This approach enhances information sharing and keeps costs to a minimum while instantly allowing appropriate individuals to access the latest updated information.

Conclusions

Federal and state animal health regulatory officials must have assurance that an egg-production site located within a control area is free of HPAI virus before movement of eggs and egg products can be allowed. Incident commanders can be confident that any given FAST Eggs Plan premises had a stringent biosecurity program in place prior to the outbreak and that no epidemiological links to infected premises are known to exist. Geographic coordinates for FAST Eggs Plan premises can be compared with coordinates of infected premises and used to quickly determine the distance between the 2 locations. During the chaotic early days of an outbreak, the GRE can be used by incident commanders to assess the likelihood that FAST Egg Plan premises will be exposed to HPAI virus from infected premises. Daily reports posted on the FAST Eggs Plan premises Web site will provide the surveillance-epidemiology task force in the incident command structure with RRT-PCR assay results, mortality rates, feed consumption, and egg production for each house on FAST Eggs Plan premises. Use of Web-based information will allow incident commanders to quickly determine whether shell eggs and liquid egg products from FAST Eggs Plan premises can be allowed to resume movement into market channels with minimal risk to the safety of animal or human health. Information from the Web page of FAST Eggs Plan premises and daily diagnostic test results can be used by state and federal animal health officials to make decisions regarding issuing permits for movement of eggs and egg products out of a control area during an HPAI outbreak. Before eggs and egg products from FAST Eggs Plan premises are allowed to move into market channels during the initial days after a control area is established, excellent biosecurity must be in place; mortality rates, egg production, and feed and water consumption must be within usual limits; no epidemiological links to the infected premises must have been identified; and results of PCR assays from each house must be negative.

The FAST Eggs Plan will facilitate business continuity and economic survival of participating noninfected egg operations in a control area after an outbreak of HPAI. Implementation of the plan will also help ensure the continuous availability of safe eggs and egg products for consumers. Robust biosecurity programs in place prior to an outbreak and daily documentation of the disease-free status of FAST Eggs Plan premises will reassure trading partners and consumers of the safety of eggs and egg products. Raising the degree of biosecurity in participating egg operations will further enhance food security by preventing introduction of other foreign and domestic diseases into table-egg flocks.

We believe that the FAST Eggs Plan will serve as an excellent model for other commodity groups seeking to promote business continuity while ensuring the safety of food products originating from livestock operations in a control area. For example, a FAST Milk Plan, FAST Beef Plan, and FAST Pork Plan may be advantageous to dairy, beef, and pork producers and help protect the nation's food supply.

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