A Collaborative Research Project Funded by:

DFID Department for International Development

Implemented by:

Royal Veterinary College University of London

in collaboration with

Key Findings

- Risks of introducing HPAI virus into buffer zones were estimated as 'negligible' to 'very low'.
- Assuming introduction of HPAI virus, risks of spread within buffer zones were considered 'very high' for introduction by live poultry and 'medium' for introduction by wild birds.
- More detailed risk assessments are needed for backyard farmers' poultry trade and fighting cock activity

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region

HPAI Research Brief | No. 13 - Year: 2009

Qualitative Risk Assessment of the Risk of Introduction and Transmission of H5N1 HPAI Virus for 1-km Buffer Zones Around Compartmentalised Industrial Poultry Farms in Thailand

S. Kasemsuwan, C. Poolkhet, T. Patanasatienkul, N. Buameetoop, M. Watanakul, K. Chanachai, K. Wongsathapornchai, R. Métras, C. Marcé, A. Prakarnkamanant, J. Otte and D. Pfeiffer

In Thailand, H5N1 infection was first reported on January 23, 2004 at a layer farm in Suphanburi province. Subsequently, several epidemic waves spread through Thailand, adversely affecting poultry farmers' livelihoods, commercial poultry production in general and human health, as well as tourism. In response to these epidemics, the Thai Department of Livestock Development (DLD) implemented various control measures, which encompassed stamping out of affected poultry flocks, pre-emptive culling of at-risk flocks, restricting poultry movements, banning free-range duck keeping, and improving bio-security and hygiene systems on poultry farms. Furthermore, DLD introduced a compartmentalisation system for commercial poultry enterprises. Implementation of these measures significantly reduced the incidence of HPAI outbreaks.

'Compartmentalised' poultry farms are mainly broiler production units belonging either to companies or to contract farmers. A key requirement for these farms is that specific disease surveillance and prevention activities (e.g. routine clinical surveillance and sampling of cloacal swabs) are carried out within a buffer zone of 1-kilometre (km) radius around the farm.

It is believed that compartmentalisation has had a significant impact in preventing further HPAI H5N1 epidemics in Thailand, much in contrast to other Mekong countries, which continue to experience small to medium scale outbreaks and minor epidemics.

In order to assess needs and possibilities for further HPAI risk mitigation in relation to poultry production within the buffer zones, DLD decided to conduct a formal risk assessment (RA) of HPAI virus (HPAIV) introduction ('release') and spread in the 1km buffer zone. The RA was conducted by national risk assessors drawing on expertise from local scientists, field practitioners, and published as well as unpublished epidemiological knowledge.

A key advantage of this formal approach is that it transparently describes the relevant risk pathways and logic of the associated process of risk estimation. Due to the potentially large number of risk pathways to consider, information gaps, and to increase transparency of the process, a qualitative rather than quantitative approach was used.

Risk Question

The 'Risk Question' posed by the Thai RA team was: "*What is the probability of introduction and transmission of H5N1 HPAIV for the 1-km buffer zone surrounding a compartmentalised (integrated) poultry farm in Thailand*?"

Risk Pathways

The RA team developed risk pathway diagrams for the 'release', i.e. the likelihood for introducing the HPAIV subtype H5N1 into a buffer zone as shown in Figure 1. Seven risk pathways with the potential of **introducing** HPAIV subtype H5N1 into a buffer zone were identified: (i) migratory birds, (ii) pests (such as rats and mosquitoes), (iii) free-ranging ducks (from outside the zone), (iv) fomites (including feeds, fertilizers and vehicles), (v) activities associated with semi-intensive poultry production (sectors 2 and 3, e.g. introduction of day-old chicks), (vi) activities associated with backyard poultry production (sector 4, e.g. introduction of live birds including fighting cocks); and (vii) poultry products.

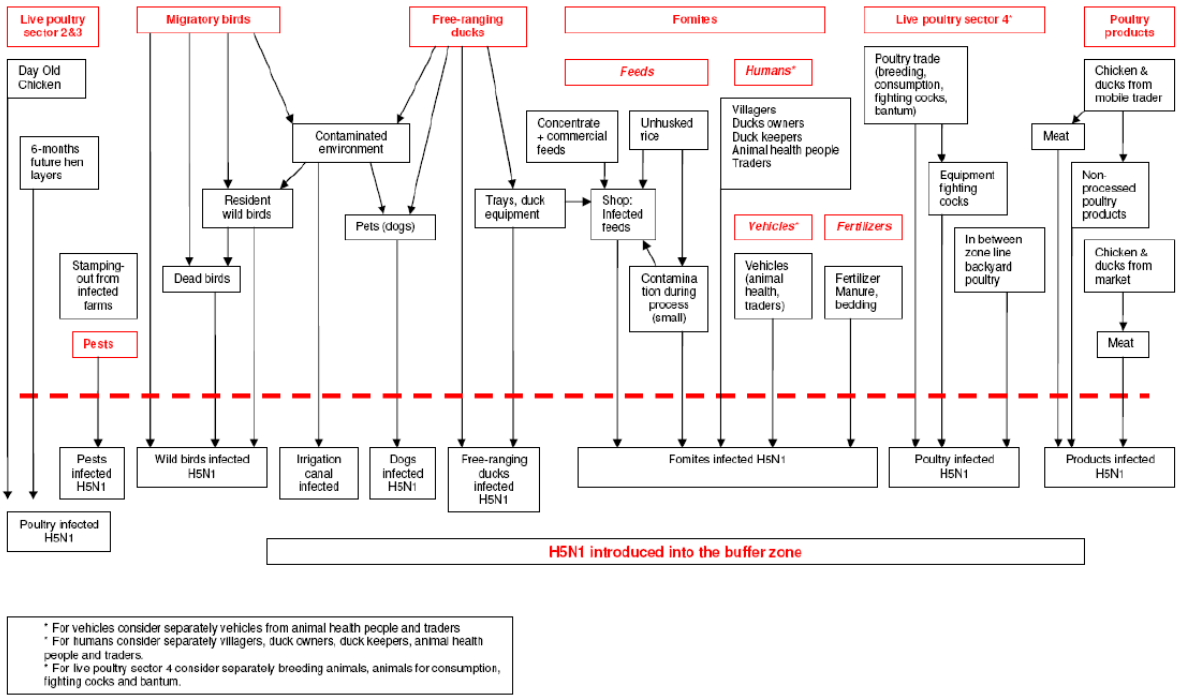

Figure 1: Possible pathways for the introduction of HPAIV H5N1 into 1km buffer zones around compartmentalised farms

Risk Estimation

The risk of introducing the HPAIV subtype H5N1 into a buffer zone via live poultry, wild birds, free-ranging ducks, humans and fertilizers were considered 'very low' with uncertainty varying between pathways, while the risks of virus introduction through the remaining pathways were considered to be 'negligible' (see Table 1).

Table 1. Estimated risks and uncertainties for HPAIV H5N1 release pathways

Pathways for introduction of HPAIV subtype H5N1 into a buffer zone via:	Risk	Uncertainty
Live poultry	Very Low	High
Resident and migratory wild birds	Very Low	Medium
Free-ranging ducks	Very Low	Low
Humans (infected or contaminated)	Very Low	Medium
Fertilizer	Very Low	Medium
Feed	Negligible	Low
Vehicles	Negligible	High
Equipment	Negligible	Medium
Water	Negligible	Low
Poultry products	Negligible	High
Dogs and cats (infected or contaminated)	Negligible	Medium
Pests	Negligible	Medium

Following these risk pathways to the likelihood of exposure and infection of susceptible poultry, the probability of transmission of HPAIV subtype H5N1 within a buffer zone was considered very high for introduction via live poultry and medium for introduction via wild birds (Table 2). The likelihoods for other exposure pathways leading to infection and spread within the buffer zone, including introduction via free-ranging ducks, fertilizers and humans were judged to be low or very low.

Table 2. Estimated risks and uncertainties for HPAIV H5N1 exposure and infection pathways

Pathways for exposure to and transmission of HPAIV H5N1 within a buffer zone from:	Risk	Uncertainty
Introduced infected live poultry to domestic poultry	Very High	High
Infected wild birds to domestic poultry	Medium	Medium
Infected or contaminated humans to domestic poultry	Low	High
Contaminated fertilizer to domestic poultry	Very Low	Medium
Infected free-ranging ducks to backyard poultry	Very Low	Medium

The overall estimates of the risks of the introduction of HPAIV subtype H5N1 and its subsequent spread in the 1 km zone were 'very low' or 'negligible' for all pathways considered due to the risk of introduction being 'very low' (Table 3). The uncertainty associated with these estimates is however 'medium' or 'high'.

Table 3. Individual and combined risk estimates for introduction and spread of HPAIV subtype H5N1 for 1-km buffer zones surrounding compartmentalised poultry farms in Thailand

	Release		Exposure & Spread		Release, Exp. & Spread	
Pathways	**Risk**	**Uncertainty**	**Risk**	**Uncertainty**	**Risk**	**Uncertainty**
Live poultry	Very Low	High	Very High	High	Very Low	High
Wild birds	Very Low	Medium	Medium	Medium	Very Low	Medium
Free-ranging ducks	Very Low	Low	Very Low	Medium	Negligible	Medium
Humans	Very Low	Medium	Low	High	Negligible	High
Fertilizers	Very Low	Medium	Very Low	Medium	Negligible	Medium

Conclusions and Recommendations

It is very encouraging that it was concluded that the overall risk for the key pathways was negligible for free-ranging ducks, fertilizer and humans, and very low for wild birds and live poultry. It needs to be recognised though that most of these estimates were associated with significant levels of uncertainty.

It is evident that the overall risk is only negligible to very low as a result of the negligible or very low risk of pathogen introduction (=release). It is important to monitor that risk level and to keep it negligible to very low, since the risk estimates for the exposure pathways indicate that introduction of the virus is likely to result in rapid spread.

The high level of uncertainty associated with many of the risk estimates, specifically for the pathways relating to live poultry and humans, indicate that there are significant knowledge gaps and that therefore the risk estimates need to be interpreted with caution. Targeted data collection should be initiated to fill some of the relevant knowledge gaps. The areas in particular need of data are the prevalence of HPAI in wild birds, the movement patterns of live poultry, particularly those of free-ranging ducks and fighting cocks.

The release pathways associated with live backyard poultry should be subjected to more detailed investigation. It was determined that they consist in fact of two separate pathways, one related to live backyard poultry trade and the other to fighting cock activity of backyard poultry farmers. Fighting cock activity in particular is likely to be associated with informal contacts and bird movements that may represent increased levels of risk for introduction of HPAI virus into a buffer zone. A quantitative risk assessment combined with targeted data collection should be conducted for these two specific pathways.

This risk assessment demonstrates how decision making in relation to disease control can be underpinned effectively by transparent presentation of data and qualitative risk estimates. Apart from defining risk pathways and estimating risks, this risk assessment compiled and documented the existing published literature and the local, unpublished epidemiological knowledge in relation to the defined pathways. It also showed how peer-reviewed information can be combined with expert opinion, while still being transparent about areas where scientific evidence is lacking.