

Highly Pathogenic Avian Influenza transmission risks: analysis of biosecurity measures and contact structures in Dutch poultry farming

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Introduction

In the 2003 Dutch epidemic of HPAI A virus subtype H7N7,

- 255 flocks (mainly layers) were affected, 30 million birds culled and 89 people infected with 1 fatality
- direct control costs amounted to 250 million Euros (indirect costs much higher)
- virus continued to spread even after implementing the EU recommended control strategies and between 80% to 90% of the cases occurred through untraced routes

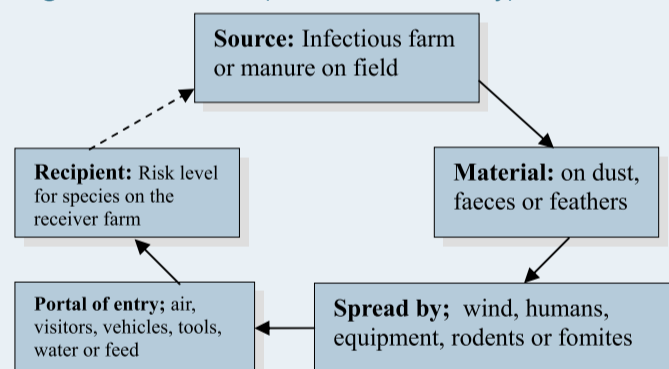
Study aim: To identify possible mechanisms underlying the between-farm spread of highly pathogenic avian influenza virus among poultry farms in The Netherlands.

- analysis is exploratory; aiming to identify all "risky" events throughout the production round.
- Farm selection was intended to cover all the different husbandry systems used in the Dutch poultry industry.

Materials and Methods

- Development of a mathematical model to study the possibility of windborne spread
- Interview study to collect information about (potential) contact risks between farms and biosecurity measures
 - First round: 22 layer, 14 broiler, 4 turkey and 2 duck farmers
 - Second round: various poultry-related firms and professionals

Fig. 1. A Schematic representation of our hypotheses



Various scenarios are envisaged, for example:

- multi-stage process e.g., wind blows contaminated dust between locations and thereafter transported by other fomites into the farm,
- a farm visitor (humans, vehicles, rodents and insects) gets into contact with infectious material and visits another (susceptible) farm.

Conclusions

- Many between-farm contacts with "in-house" visits posing a greater risk.
- Practices like sharing of labour, equipment and delivery trucks, re-use of egg trays and unclean manure containers are risky
- Presence, in the farm neighbourhood, of agricultural fields using manure and water bodies accessed by wild birds may expose the farm.
- Veterinarians, Inspectors and other visitors seem to be complacent about biosecurity protocols.

Next steps

- Build models for transmissions risks based on the scenarios found
- Devise means on how to prioritize hygiene measures in relation to the risk of introduction and/or spread of HPAI.

Key results

- **Biosecurity issues:**
 - most farms have showers that are never used
 - violation of biosecurity protocols during restocking
 - personal belongings are brought into poultry houses
 - hardly any farm has designated clean/dirty routes
 - no biosecurity protocols for the truck drivers
 - no wheel disinfection systems for some of the delivery trucks
 - shared equipment was not always cleaned
 - hardly any farm has protection against contamination by manure
- **Contact risks through:**
 - hired labour and regular farmer-meetings on farms
 - farmers and helpers accessing poultry on other premises
 - some farmers attracting visitors by selling farm products
- **Water waste was most often disposed on the farm grassland producing contamination risks to e.g. surface water**
- **Flock thinning and spiking causes frequent visits by catching teams as well as some animal movements between farms**

Table 1. Summary of key results on contact structures and biosecurity

	Layers (n=13)	Broilers (n=9)
General information		
#farms with >1 locations	5	0
#birds on the farm: mean (min-max)	39439(3350-130000)	52791(180-160000)
#farms with multiple-age system	4	0
#farms with manure being used in neighbourhood (on farm)	2(3)	2(2)
#farms using community (well) water	7(6)	6(3)
#farms where manure container and/or truck not always cleaned	2	3
#farms that re-use egg trays	11	na
#farmers dissatisfied with hygiene of trays and/or containers, pallets	7	na
#farms with >1 feed suppliers (>1 deliveries per week)	2(3)	1(5)
#farms using feed supplements (>1 suppliers)	9(4)	7(1)
#times (average) bedding are supplied per year	1.7	4.5
#farms that own all equipment used on farm	9	9

Table 2. Summary of "risky" visitor behaviours

	Freq of visits per cycle: mean(min-max)		Use biosecurity transit room		Enter poultry houses		Deviate from protocol	
	Layers	Broilers	Layers	Broilers	Layers	Broilers	Layers	Broilers
Veterinarians	1.9(0-5)	8.7(2-23)	11/11	9/9	8/11	8/9	1/11	0/9
Feed mill technicians	13.4(0-32)	3.1(0-10)	11/12	7/8	10/12	6/8	1/12	0/8
Hatchery technicians	6.3(0-20)	0.9(0-4)	10/11	4/4	10/11	1/4	0/11	0/4
Repair technicians	1.5(0-5)	1.3(0-4)	9/10	5/5	10/10	3/5	3/10	0/5
Inspectors	2.8(0-8)	1.8(1-3)	10/13	6/9	4/13	1/9	2/13	0/9
Catchers	1.1(0-2)	1.1(1-2)	11/13	8/9	13/13	9/9	2/13	0/9
Vermin Control	1.9(0-10)	0.1(0-1)	4/5	1/1	5/5	1/1	0/5	0/1