# Prevalence and Risk Factors for Swine Influenza in English Pig Farms

Royal Veterinary College
University of London

Barbara Wieland[1], Alexander Mastin[1], James Wood[2], Susanna Williamson[3], Ian Brown[3], COSI consortium, Dirk Pfeiffer[1]

1. Royal Veterinary College, London, UK
2. University of Cambridge, UK
3. Veterinary Laboratories Agency, UK

## Background

Pigs are an important reservoir of H1N1, H1N2 and H3N2 influenza viruses, strains of which are endemic in pigs worldwide. Swine influenza virus (SIV) can also contribute to substantial economic loss in pig production due to respiratory disease.
Since 1991, the UK has monitored SIV through a national surveillance programme and identified avian-like H1N1, followed by H1N2, as the predominant strains. The programme is based on passive surveillance and therefore the true proportion of farms in England exposed to the different SIV strains and the prevalence of subclinical infection is difficult to estimate.

In order to plan future surveillance activities, improve preventive and control measures, the epidemiology of SIV in England needs to be better understood.

## M&M

In total, 2,787 sera collected from 146 farms were tested for antibodies against avian-like H1N1, H1N2 and human-like H3N2 strains using haemagglutination inhibition (HI) tests. The herd-level case-definition was a reciprocal antibody titre of >= 40 in at least one growing or finishing pig (i.e. not from sows or weaners) as this indicates recent exposure of the herd to the virus.

Spatial clustering was assessed using the spatial scan statistic.

Risk factor analysis: in the first step, univariable analysis was carried out to identify possible associations between variables and farms status. In the 2nd step, variables belonging to the same group relating to farm management or other characteristics were assessed together with multivariable models and the best predicting variables were included in the 3rd step, the final multivariable model, which was fitted using backward selection (Mastin et al, 2011).

## Objectives

1. To determine the prevalence:
   - of avian-like H1N1, H1N2 and H3N2
   - at herd and animal level
   - and to explore spatial distribution of endemic SIV strains
2. To identify risk factors for SIV at herd level

## Results

### 1. Prevalence

In total 52% (CI95%: 46-61%) of farms had evidence of recent exposure or current circulation of H1N1 or H1N2. A total of 19 farms tested positive for both H1N1 and H1N2, and no farm was classified as seropositive for H3N2. Farms in North England were more likely to test positive for avian-like H1N1, p<0.05, (Figure 1).

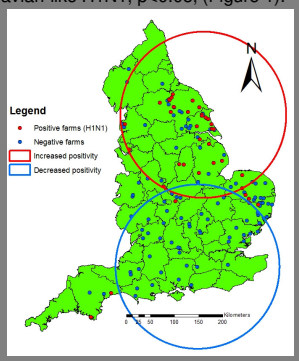


Figure 1: spatial distribution of avian-like H1N1 positive farms

H1N2 was the most prevalent strain. In the comparison of age groups, sows had the highest prevalence (Table 1).

Table 1: Overview of SIV in different age groups

| Age group (no of samples) | H1N1 | H1N2 | at least 1 strain |
|---|---|---|---|
| Weaners (711) | 2% | 8% | 9% |
| Growers (917) | 2% | 7% | 9% |
| Finishers (864) | 4% | 8% | 11% |
| Sows (253) | 19% | 29% | 38% |

### 2. Herd level risk factors

Through the 1st and 2nd step of the analysis, the variables listed in Table 2 were found to be associated with the outcome with a p-value <0.1 (as risk or protective factors), and were included in the multivariable analysis of the 3rd step. The final logistic regression model identified an increased likelihood of farm seropositivity for farms sampled in autumn, winter or spring months compared to farms sampled in summer, for farms with more than 18 pigs per water space, and for farms rearing pigs indoors. Decreased likelihood of positivity was found for farms using straw yards (Table 3). There was no evidence of any interaction between variables in the final model.

Table 2: List of potential risk/protective factors for SIV, as identified through univariable and multivariable analysis within variable groups explaining similar characteristics of the farm or of herd management (p-value<0.1):

- Total number of pigs on farm
- Location of sick pen (separate building)
- Number of litters mixed together
- Growers and finishers mixed together
- Stocking density in finishers
- Pigs kept indoors
- Use of straw yards for pigs
- Separation of boars upon entry to the farm
- By-product fed to pigs
- Pigs per feed space (weaners and growers)
- Pigs per water space (growers and finishers)
- Duration of rest from light
- Visitors pig clean
- Years of stockman experience
- Stockman participating in pig events
- Season of farm visit

Table 3: Final multirvariable model for SIV risk factors

| Variable | Odds Ratio | 95% confidence interval | p-value |
|---|---|---|---|
| **Pig access to water** | | | |
| 18 finishers or less per water space | 1.00 | - | - |
| More than 18 finishers per water space | 5.22 | 1.57 – 17.43 | 0.01 |
| **Season of sampling** | | | |
| Pigs sampled in the Summer months (July-September) | 1.00 | - | - |
| Pigs sampled at other times of the year | 2.54 | 1.09 – 5.95 | 0.03 |
| **Housing type** | | | |
| No pigs kept indoors | 1.00 | - | - |
| At least some pigs kept indoors | 3.59 | 1.11 – 11.57 | 0.03 |
| No pigs kept in straw yards | 1.00 | - | - |
| At least some pigs kept in straw yards | 0.30 | 0.11 – 0.82 | 0.02 |

## Discussion

In conclusion, the findings of this study improve our understanding of the current swine influenza situation in England and is the only such epidemiological study in the English pig population in recent years. Compared to estimates made based on passive surveillance, the prevalence found was higher than expected and also the most prevalent strain in the UK was H1N2 and not as expected avian-like H1N1. The high prevalence highlights the importance of subclinical infection, specifically that the importance of SIV as a significant production disease may have been underestimated in the past.

The findings of the risk factor analysis provide insight into how the spread of SIV can be prevented and will inform future surveillance activities. Given the recent spread of pandemic H1N1 in pigs, the findings will also be of importance to develop control strategies for this novel threat for the pig industry.

**References**
Mastin et al, 2011, PLOS currents influenza, PMCID: PMC3032880

**Contact**
*Barbara Wieland, Royal Veterinary College/UK*
*Email: bwieland@rvc.ac.uk*

bbsrc
biotechnology and biological sciences research council