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Introduction

The first outbreak of infection with pandemic influenza A (H1N1) 2009 virus (H1N1/09 virus) in a Norwegian swine herd was recorded on 10th of October 2009. Until then the Norwegian pig population was considered free of swine influenza subtype H1N1 and H3N2, as documented by a serological surveillance program running since 1997 (1). This paper describes the results of a surveillance study in the Norwegian pig population from 10th of October to 31st of December 2009.

Materials and methods

Herds. To investigate the extent of the H1N1/09 virus outbreak in Norway in October 2009, the Norwegian Food Safety Authority initiated an increased surveillance targeted at the following categories:

- Herds where the pigs had been exposed to persons with verified H1N1/09 virus infection or to persons with influenza-like symptoms (ILI).
- Herds where pigs with ILI were observed.
- Herds with a history of contact with or close proximity to infected herds.
- Serological screening of nucleus and multiplier breeding herds.

Sampling and tests. Initially most herds were tested by nasal swabs from 20 pigs. Detection of H1N1/09 virus was done at the Norwegian National Veterinary Institute, by real-time RT-PCR to detect influenza A virus (2). Positive samples were tested by H1N1/09 virus specific real-time RT-PCR (3). In addition, samples were tested at the National Veterinary Institute, Technical University of Denmark, by a H1N1/09 virus specific real-time RT-PCR (4). Later, many herds, including the nucleus and multiplier herds, were tested serologically by an enzyme-linked immunosorbent assay (ELISA, ID Screen® Influenza A Antibody Competition test, IDVET) and haemagglutination inhibition (HI) test to detect antibodies against influenza A virus on at least 20 pigs per herd. In addition, a few tracheal and bronchial swabs from pneumonic lungs, from the slaughter house were tested by RT-PCR.

Diagnostic criteria. One PCR-positive sample or five samples positive for antibodies against influenza A virus was defined as sufficient to confirm a farm as positive. If less than five samples were positive for antibodies with the ELISA, the herd was re-tested. The farm is declared negative when the re-tested second samples were all negative.

Results

Of the 114 herds tested by nasal swabs, 54 herds were positive for H1N1/09 virus, and 55 of the herds tested by serology were positive for antibodies against H1N1/09 virus as confirmed by HI test (Table 1).

Table1. Molecular and serology results for H1N1/09 virus surveillance in Norwegian swine herds from 10th of October to 31st of December 2009.

Test method	Herds tested	Herds Positive	Total samples	Positive samples
Nasal swabs	**114**	**54**	**1628**	**440**
Serology	**140**	**55**	**2659**	**659**
***Total**	**217**	**91**	**4287**	**1099**

*Some herds were tested by both RT-PCR and serology.

Genome sequencing of the virus from one pig confirmed it as identical to the virus from a sick farm staff member at the same farm and that it is at least 99.8% similar to other pandemic viruses circulating in humans in Norway.

Discussion

The majority of the positive herds, especially among the herds tested first, had a history of contact between pigs and humans whom were diagnosed with pandemic influenza or people with ILI. This suggests infected humans to be the most likely source for transmission of H1N1/09 virus to positive pig herds. Ongoing studies will evaluate the risk factors for infection in pigs, and the hypothesis that humans transmitted H1N1/09 virus to pigs. The diversity of H1N1/09 virus in the Norwegian pig population will be studied by sequencing positive samples.

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