

PANDEMIC INFLUENZA A(H1N1)v: HUMAN TO PIG TRANSMISSION IN NORWAY?

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In Norway there is an ongoing outbreak in pigs of infections with pandemic influenza A(H1N1)v virus. The first herd was confirmed positive on 10 October 2009. As of 26 October, a total of 23 herds have been diagnosed as positive. The majority of the herds seem to have been infected by humans. Sequence analysis of pig viruses from the index farm shows that they are identical or virtually identical to human viruses from the same geographical region.

Introduction

The Norwegian pig herds have been considered free of swine influenza (the classical strain H1N1 and H3N2) as documented by a serological surveillance programme running since 1997 [1]. The pig industry in Norway is relatively small with approximately 2,700 herds and a little less than 1.5 million slaughtered animals in 2008.

Responding to the emergence of a novel influenza A(H1N1) strain (hereafter called pandemic influenza) affecting humans in April 2009, the surveillance of pandemic influenza in humans was initiated in Norway in late April, as a continuation and enhancement of the seasonal influenza surveillance systems. After the first detections of the pandemic influenza virus in Norway in early May, sporadic infections, mostly in travellers from abroad, increased gradually through the summer. After a peak in late July, the numbers declined while an increasingly larger proportion of cases were infected in Norway. A new increase has been seen through October and the cumulative number of laboratory verified cases by 26 October exceeded 3,300 [2].

There are reports from the World Organisation for Animal Health (OIE), on ProMED-mail [3] and in general media from other countries (Argentina, Canada, Australia, North Ireland, Ireland, United States) that human to animal transmission has occurred with the new pandemic influenza.

This paper describes an ongoing outbreak in pigs of infections with the pandemic influenza virus in Norway, providing insights on the source of infection and on the control strategies put into force for its control.

Detection of outbreak

On 9 October 2009, the Norwegian Food Safety Authority (NFSA) was contacted by a local veterinarian who informed about

a possible outbreak of influenza in a pig herd of 85 sows and 850 growers and fattening pigs in Nord-Trøndelag County. In the period from 4 to 9 October a sow in the farrowing unit had been observed coughing. No other clinical signs of infection were observed in the rest of the herd and no animal had died. The NFSA was informed that a farm staff member had been ill with influenza-like symptoms (ILI) since 1 October, and tested positive for pandemic influenza virus on 8 October. The NFSA therefore decided to take nasal swabs from 20 pigs in the herd, and the samples were sent to the National Veterinary Institute (NVI) for analyses. On 10 October a total of 18 of the sampled pigs tested positive for influenza A and for 12 of these pandemic influenza viruses was confirmed.

An epidemiological investigation performed by the NFSA began on 11 October, and samples were collected from six additional herds located in close proximity to the index herd or with a history of close human/animal contacts. One of these, a herd with about 500 slaughter pigs, tested positive for pandemic influenza virus. This herd was owned by the infected animal handler of the index herd. This second herd positive for pandemic influenza was situated in an area with very intensive pig farming. Based on the possibility of a potential further airborne spread to neighbouring farms and with the aim to keep the Norwegian pig population free from swine influenza, it was decided to eradicate the second infected herd quickly. For animal welfare reasons and in spite of potential hazard for airborne spread during transport, all the pigs from this herd were transported to a nearby slaughterhouse and put down.

The plan was to slaughter the index herd during the same week. However, the eradication strategy was abandoned when four more herds in the area tested positive the next few days. It soon became clear that all the herds tested positive so far had been in contact with humans with ILI symptoms or with verified infection with pandemic influenza virus. At the same time, there was no evidence indicating there had been contact (pigs, staff, vehicles, etc.) between the new positive herds, and the possibility of airborne transmission was also ruled out due to long distances between the positive herds. Thus the sampling strategy was revised to include pig herds throughout Norway, having staff members with ILI or confirmed pandemic influenza, should be sampled. Later on, a revised surveillance programme for the Norwegian pig herds will be implemented.

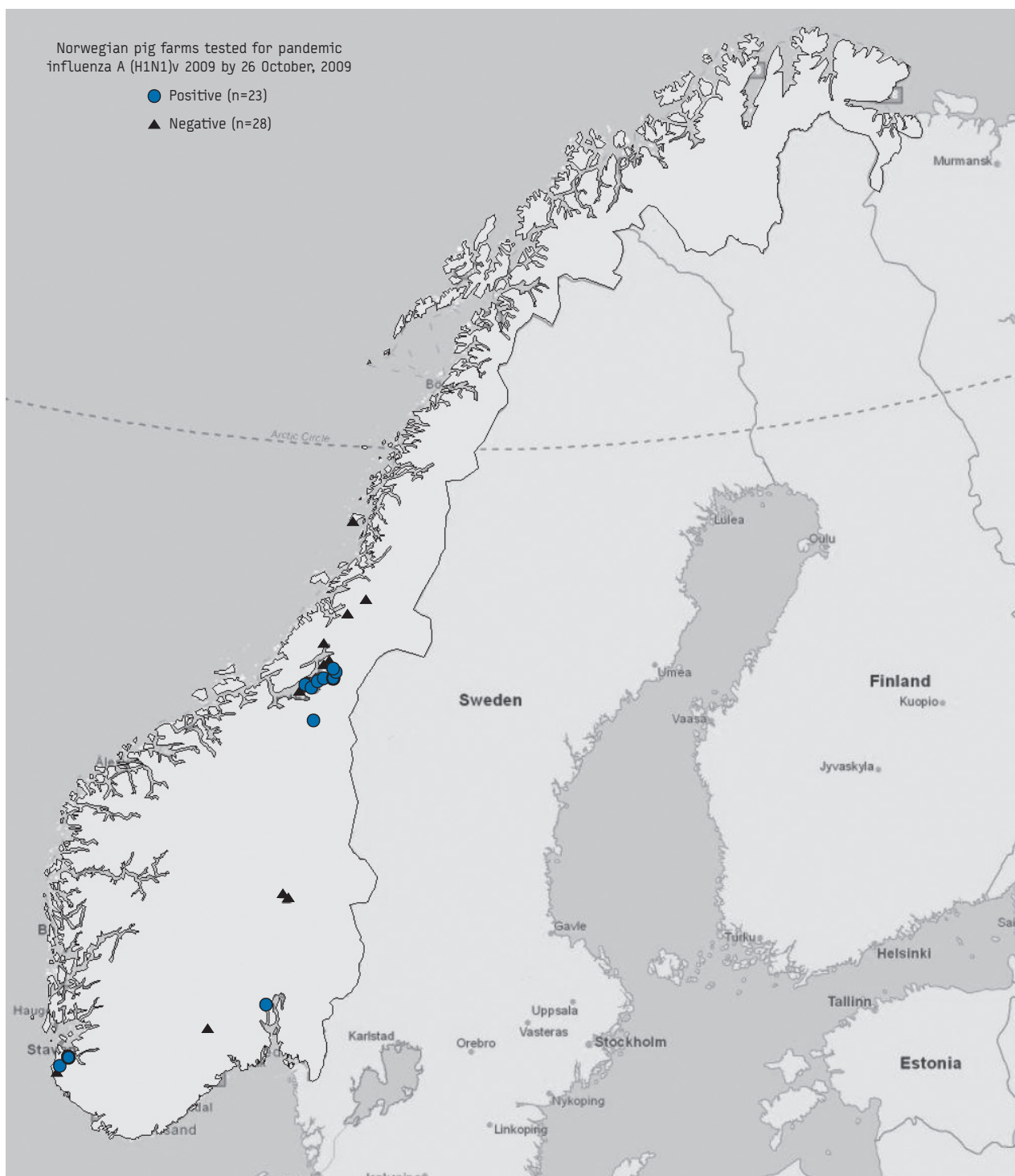
Materials and methods

All herds except two, have been sampled by 20 nasal swabs. These swabs have been tested at the NVI by real-time RT-PCR to

detect influenza A [4]. Samples positive in this test have also been tested for the pandemic influenza A(H1N1)v virus subtype [5]. The remaining two herds were sampled by 20 blood samples and

FIGURE

Pig herds tested for pandemic influenza A(H1N1)v virus, 10 October – 26 October, Norway, 2009 (n=51)



tested by enzyme-linked immunosorbent assay (ELISA, ID Screen® Influenza A Antibody Competition test, IDVET) and for subtype A(H1N1)v by haemagglutination inhibition test.

Results

In Nord-Trøndelag County, in the period between 10 October and 26 October, a total of 39 herds were tested and 18 of these were positive for pandemic influenza. Of these 18 positive herds, a total of 15 herds were in contact with people diagnosed with pandemic influenza (n=10) or with people with ILI symptoms (n=5). For the three remaining herds, there is no available information on such contact.

So far, in six of the 18 positive herds in Nord-Trøndelag County the clinical status of the herd has been recorded. Moderate clinical signs of influenza (coughing, fever) were recorded in four herds, while signs were mild to non-existing in two herds. In five of these six herds, the clinical signs in the pigs occurred after humans in contact with the pigs became ill.

In addition, during the period 12 October to 26 October, a total of 12 herds from six other counties were tested and five herds from three counties were positive for pandemic influenza virus. Also in these counties, the majority of positive herds are suspected of having contracted the virus from infected people.

The influenza virus in specimens taken from the index herd in Nord-Trøndelag has been sequenced at the Norwegian Institute of Public Health and compared to human strains from Norway and elsewhere, including the virus from the initial human case associated to the outbreak on this farm. The virus from two individual animals showed full identity in the two genome segments analysed for both pigs (full length H1 and 727 nt partial N1). There was also full identity to the 1,744 nt H1 gene of the virus from the farm staff member. Very high similarity was also observed to some of the viruses isolated from other humans in Norway, in particular to a virus found in the same geographical region. Within the entire 1,744 nt H1 and 727 nt N1 sequences compared, a difference in only one nucleotide in H1 was observed (99.9 and 100% identity, respectively). Full genome sequencing of the virus from one of the swine specimens confirms a very high similarity throughout the viral genome to the pandemic virus circulating in humans.

Discussion

In this investigation, humans infected with the pandemic influenza virus seem to be the most likely source for the spread of the infection to the pigs, even though additional routes, like airborne transmission or transmission by vehicles cannot be ruled out at the moment. So far, no evidence has suggested that animals play any particular role in the epidemiology or the spread of the pandemic influenza among humans. [6].

The Norwegian pig population has until this outbreak been free of classical swine influenza. The current situation thus presents an acute challenge for the pig industry and the NFSA. This has major long term implications for both the pig industry and for the public in terms of zoonotic potential. Transmission from humans to pigs and the possible vice versa is especially worrying. In addition pigs could potentially be effective multipliers for the virus, and might act as reservoirs of the virus during the out-of-season periods when the virus does not circulate in humans. Also, the virus could possibly further re-assort in case of swine or avian influenza viruses co-circulation, or mutate within the pigs to produce a more virulent

strain [8]. The Norwegian authorities have taken several measures to control the outbreak such as monitoring the situation and the affected farms closely and restricting movements of animals from affected farms. Furthermore Norway follows the European Union working document [7] which recommends not slaughtering animals before at least seven days after the termination of clinical signs.

Further investigations are being carried out to clarify the extent of the outbreaks in the rest of Norway. Studies are also underway to evaluate risk factors for the infection at farm level. Farmers claim to maintain proper biosecurity as change of clothes and the use of face mask (surgical mask, gauze mask) before any contact with the pigs. However, due to lack of extra hands, on several occasions it had been necessary for the farmers to attend the pigs in spite of having influenza symptoms.

To further test the hypothesis that the pigs are infected by humans, follow up investigations should gather detailed information on directionality of transmission, such as what time point the farmer and the pigs showed signs of illness. To assist in such investigations, the results from nasal swabs taken initially and additional serological results should be further studied. Virus isolates from possible human and pig "pairs" are also available and can be further characterized.

Acknowledgements

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