3rd International Conference on Influenza and Zoonotic Diseases August 21-22, 2017 Birmingham, UK- Occurrence and spread of influenza A(H1N1)pdm09 virus infection in norwegian pig herds based on active serosurveillance from 2010 to 2014

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Abstract

The incursion of influenza A(H1N1)pdm09 virus was detected by Norway's active serosurveillance of its pig population in 2009. Since then, surveillance data from 2010 to 2014 revealed that 54% of 5643 herd tests involving 1567 pig herds and 28% of 23 036 blood samples screened positive for antibodies against influenza A virus. Positive herds were confirmed to have influenza A(H1N1)pdm09 virus infection by haemagglutination inhibition test. In 50% of positive herd tests, 560% of the sampled pigs in each herd had antibodies against influenza A(H1N1) pdm09 virus. This within-herd animal seroprevalence did not vary for type of production, herd size or year of test. The overall running mean of national herd seroprevalence, and annual herd incidence risks fluctuated narrowly around the means of 45% and 32%, respectively, with the highest levels recorded in the three densest pig-producing counties. The probability of a herd being seropositive varied in the five production classes, which were sow pools, multiplier herds, conventional sow herds, nucleus herds, and fattening herds in descending order of likelihood. Large herds were more likely to be seropositive. Seropositive herds were highly likely to be seropositive the following year. The study shows that influenza A(H1N1)pdm09 virus is established in the Norwegian pig population with recurrent and new herd infections every year with the national herd seroprevalence in 2014 hovering at around 43% (95% confidence interval 40–46%).

Introduction:

Influenza A viruses (IAVs) are ubiquitous in both humans and animals, and are endemic in most pig populations worldwide [1–6]. Several short-term influenza virus surveillance systems in the last two decades [7–13] revealed that the dominant circulating swine influenza A viruses (swIAVs) in European pigs were: the Eurasian avian-like H1N1 [14], human-like H3N2 [15], and triple assortant (swine, human, avian) H1N2 [4]. The most recent virus being influenza A(H1N1)pdm09 virus (H1N1pdm09), which joined the ranks of the preceding three subtypes with increasing incidence from 2010 [13, 16]. Subtype H1N1pdm09 was first reported in humans in April 2009, in North and South America [17]. Following outbreaks in humans, pig-producing countries worldwide increased their surveillance activities and also reported the detection of H1N1pdm09 in their pig populations.

Materials and Methods:

The 5-year surveillance data from 1 January 2010 to 31 December 2014 involved 1567 pig herds (~75% of the 2000 pig herds in Norway based on the National Registry of Pig Herds, 2014) with a total of 5643 herd tests and a total of 23 026 individual blood samples. Pig herds in the sampled population were classified into five production classes: fattening; nucleus herds; multiplier herds; conventional sow herds, and (5) sow pools. These five classes of pig herds form the breeding and health pyramid that creates a unidirectional animal flow in the production of pig meat. At the top are the closed nucleus herds (n ≈ 40) where pure genetic lines are constantly improved. Expanding in the next level are the multiplier herds (n ≈ 60) where some multiplier herds are closed and most are associated with one nucleus herd. They produce maternal lines of Landrace-Yorkshire (LY) cross and supply gilts to conventional sow herds, which include both integrated and piglet-producing herds. Nevertheless, some commercial sow herds do replenish their sow numbers with gilts from their own production. Unique to Scandinavian countries with their small sow herds, the sow pool system in Norway involves a cooperation between 10–20 pig producers where one central gestation herd supplies the cooperating producers (satellite units) with pregnant sows in a leasing system.

Laboratory analyses and herd diagnosis

All serological analyses were performed at the Norwegian Veterinary Institute in Oslo. A commercial competitive ELISA (ID Screen® Influenza A Antibody Competition multi-species kit; ID VET, France) with a reported sensitivity of 93% and specificity of 99% (manufacturer's data) was the screening test for serum antibodies against IAV. The ELISA test can detect IAV antibodies in any species including pigs. Titres ⩾40 were considered positive for IAV antibodies. In cases of positive or inconclusive results, the serum samples were re-tested using the haemagglutination inhibition test (HI), to detect antibodies against the four antigens, namely H1N1pdm09 (A/California/07/2009), European H1N1 [A/Sw/Belgium/1/98 (H1N1)], H1N2 [A/Sw/Gent/7623/99(H1N2)] and H3N2 [A/Sw/Flanders/1/98(H3N2)]. CDC identified and described the first

antigen [32], while the latter three antigens were identified and described in Belgium [33]. Testing of these serotypes have been described in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. A herd was considered positive if at least one blood sample serially tested positive with ELISA first, followed by an HI test using antigens produced at the Norwegian Veterinary Institute. Pigs with an antibody titre 10 in the HI test for a given subtype were regarded as positive or considered a cross-reaction if more than one type of antigen reacted positively. The herd-level diagnosis was based on which subtype had the highest mean titre, and the highest prevalence in a single herd test. Antigen reactions other than H1N1pdm09 were considered cross-reactions because they were either lower in titre, fewer in proportion in positive reactions, and unlike H1N1pdm09, they did not exist as single antigen reactions in any of the blood samples examined.

Results:

Herd seroprevalence, temporal trends

Surveillance data of 5643 herd tests on 23 039 samples from 2010 to 2014 showed that 6513 (28%) of the samples screened ELISA positive for antibodies against IAV in 2470 herd tests. Of these blood samples positive for antibodies against IAV, 5857 were confirmed by the HI test to be antibodies against H1N1pdm09 with 23•6% showing reactions to sole antigen H1N1pdm09. Seventy-six per cent of the samples with reactions to multiple antigens in addition to H1N1pdm09 were all deemed cross-reactions by our criteria for herd diagnosis.

Note: This work is partially presented at 3rd International Conference on Influenza and Zoonotic Diseases Occurrence and spread of influenza A(H1N1)pdm09 virus infection in norwegian pig herds based on active serosurveillance from 2010 to 2014 on August 21-22, 2017.