Annual Report

The surveillance programme for specific viral infections in swine herds in Norway 2017

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Content

Authors
Carl Andreas Grøntvedt, Anne Bang Nordstoga, Chiek Er

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Summary

The surveillance programme for specific viral infections in swine herds in 2017 continued to show Norway to be free from Aujeszky's disease, transmissible gastroenteritis, porcine epidemic diarrhoea virus, porcine respiratory corona virus and porcine respiratory and reproductive syndrome. Norway recorded its first outbreak of swine influenza, influenza A (H1N1) pdm09 virus (H1N1pdm), in 2009. During 2017, the national herd prevalence remained above 40% at 41% (95% CI 37-46% or 225/ 548 herds), although there was a slight decline of 7% (95% CI 0.7-12.4%) compared to 2016. Except for H1N1pdm, Norwegian swine population was tested negative against other strains of influenza A virus that are endemic in most pig producing countries.

Introduction

The Norwegian Food Safety Authority is responsible for implementing the surveillance programme for specific viral infections in swine. The national surveillance programme for specific viral infections in swine was launched in 1994 to document the status of Aujeszky's disease (AD), transmissible gastroenteritis (TGE), and porcine respiratory corona virus (PRCV) in the Norwegian swine population. Porcine respiratory and reproductive syndrome (PRRS) and swine influenza (SI) were added to the programme in 1995 and 1997, respectively. From 1997 to 1999, and again from 2015, porcine epidemic diarrhoea (PED) was also included in the programme. The Norwegian Veterinary Institute is responsible for planning, laboratory investigations and reporting components of the programme.

The EFTA Surveillance Authority (ESA) has recognized Norway's disease-free status for AD since July 1 1994, and has laid down additional measures for the trade of pigs and pork to protect Norway's disease free status for AD. The additional measures are described in ESA Decision No 160/10/COL.

Aims

The aims of the serological surveillance programme are to ascertain the continued absence of specific infectious diseases and to contribute to the maintenance of this favourable situation. The programme also monitors the status of H1N1pdm infection in the Norwegian swine population.

Materials and methods

Herds and sampling

All the 88 nucleus and multiplying herds as well as the nucleus units of all 12 sow pools were included in the programme. Blood samples from ten adult swine in each herd were collected, usually at the farms, but occasionally also at the abattoirs. In addition, a selection of the remaining Norwegian swine herds was included in the programme. At the 12 largest abattoirs where more than 97% of the pig slaughter takes place, blood samples proportional to the number of sows and boars per herd were collected. The samples were randomly collected from different herds and the sampling periods were evenly distributed throughout the year. Furthermore, at the six largest abattoirs, ten blood samples were collected from 43 randomly selected large fattening herds.

Laboratory analyses

All serological analyses were performed at the Norwegian Veterinary Institute in Oslo. Positive or inconclusive results in the surveillance programme were retested in duplicate with the same test method. Samples were concluded as negative if the retest gave a negative result. If the result of the retest was positive or inconclusive, a specified confirmatory test was performed. In cases of positive or inconclusive test results for confirmatory tests (except for H1N1pdm virus which is enzootic in Norway), at least 20 new pigs were resampled from the herd in question. If clinical signs of disease were absent in the herd, and all

resampled animals were negative for antibodies against the pathogen in question, a single positive or inconclusive sample in the surveillance programme was considered false positive.

Aujeszky's disease/pseudorabies virus (ADV/PRV)
All serum samples were tested for antibodies against ADV using a commercial blocking ELISA from Svanova (SVANOVIR® PRV gB-Ab). The test detects antibodies against glycoprotein B (previously glycoprotein II) found on the surface of the virus. A virus neutralisation test (VNT) was used as confirmatory test for positive or inconclusive results.

Transmissible gastroenteritis virus (TGEV) and porcine respiratory coronavirus (PRCV)
A commercial blocking ELISA from Svanova (SVANOVIR® TGEV/PRCV-Ab) was used to detect antibodies against TGEV/PRCV. The ELISA test enables discrimination between antibodies to TGEV and PRCV in serum samples. In cases of positive or inconclusive results, the samples may be sent to the OIE reference laboratory.

Porcine reproductive and respiratory syndrome virus (PRRSV)
All serum samples were tested for antibodies against PRRSV using a commercial indirect ELISA from IDEXX (IDEXX PRRS X3), which detects the most (pre)dominant European and American strains of PRRSV. In cases of positive or inconclusive results, the samples were sent to the National Veterinary Institute (DTU Vet) in Denmark for confirmatory testing using ELISA and immunoperoxidase tests for detection of antibodies against EU- and US-strains of the PRRSV.

Swine influenza virus (SIV)
A commercial competitive ELISA from IDvet (ID Screen® Influenza A Antibody Competition, Multi-species) was used to screen serum samples from swine for antibodies against influenza A virus. In cases of positive or inconclusive results, the serum samples were retested using the haemagglutination inhibition (HI) test, for the detection of antibodies against the A/Swine/California/07/09 (A/H1N1/pdm09), A/Swine/Belgium/1/98 (H1N1), A/Swine/Gent/7623/99 (H1N2) and A/Swine/Flanders/1/98 (H3N2) subtypes as described in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. The antigens for the tests were produced at the Norwegian Veterinary Institute.

Porcine epidemic diarrhoea virus (PEDV)
All serum samples were tested for antibodies against PEDV using a commercial indirect ELISA from IDvet (ID Screen® PEDV Indirect). In cases of positive or inconclusive results, the samples were sent to the National Veterinary Institute (DTU-Vet) in Denmark for confirmatory testing using an in-house ELISA.

Results and Discussion

The distribution of sampled herds in relation to production type is given in Table 1. The mean number of animals tested per farm aggregated for the year was 7 (range 1 - 40).

Only a few of the collected samples were rejected, resulting in 3,804 individual pig samples representing 548 herds being analysed (Table 2). Of the 548 tested herds, 225(41%) were seropositive for H1N1pdm. The proportion of herds tested positive by region varied from 7% in the aggregated counties of Finnmark/Troms/Nordland to 65% in the counties of Rogaland and Agder (Table 3).

The results from the surveillance programme in 2017 showed that Norway has maintained its freedom of disease status for AD, TGE, PRCV and PRRS virus infections in the national swine population since the surveillance started in 1994.

Table 1. Distribution of swine herds in the surveillance programme 2017 according to type of production and the results for antibodies to H1N1pdm.

Category	No. of herds sampled (no. of pigs sampled per herd)	No. (%) of positive herds H1N1pdm
Nucleus herds and multiplying herds	88 (2-30)	35 (40)
Sow pools	12 (15-40)	11 (92)
Integrated and piglet-producing herds	404 (1-34)	168 (42)
Fattening herds	44 (10-11)	11 (25)
Total herds (pigs)	548 (3 804)	225 (41)

Table 2. Results from the surveillance for Aujeszky's disease (AD), transmissible gastroenteritis (TGE), porcine respiratory corona virus (PRCV), porcine epidemic diarrhoea (PED), porcine respiratory and reproductive syndrome (PRRS) and swine influenza (SI) from 1994 to 2017.

Year	Total no. of herds	Herds tested	Animals tested	H1N1pdm		Other viruses		Diseases included
				Animals positive	Herds positive	Animals positive	Herds positive	
1994	7 799	1 112	12 010	-	-	0	0	AD, TGE, PRCV
1995	7 471	956	11 197	-	-	0	0	AD, TGE, PRCV, PRRS
1996	7 045	468	4 968	-	-	0	0	AD, TGE, PRCV, PRRS
1997	6 661	512	4 925	-	-	0	0	AD, TGE, PRCV, PRRS, SI, PED
1998	6 275	491	4 695	-	-	2[1]	1[1]	AD, TGE, PRCV, PRRS, SI, PED
1999	5 761	470	4 705	-	-	0	0	AD, TGE, PRCV, PRRS, SI, PED
2000	4 827	458	4 600	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2001	4 554	472	4 972	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2002	4 150	492	4 899	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2003	4 005	483	4 783	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2004	4 006	492	4 935	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2005	3 762	468	4 644	-	-	1[2]	1[2]	AD, TGE, PRCV, PRRS, SI
2006	3 339	457	4 569	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2007	3 010	456	4 641	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2008	2 682	487	4 845	-	-	0	0	AD, TGE, PRCV, PRRS, SI
2009	2 546	452	4 724	131	20	0	0	AD, TGE, PRCV, PRRS, SI
2010	2 441	459	4 250	940	189	0	0	AD, TGE, PRCV, PRRS, SI
2011	2 346	730	4 713	2 216	353	0	0	AD, TGE, PRCV, PRRS, SI
2012	2 213	764	4 961	2 412	378	0	0	AD, TGE, PRCV, PRRS, SI
2013	2 178	737	5 038	1 417	338	0	0	AD, TGE, PRCV, PRRS, SI
2014	2 117	622	4 083	1 138	296	0	0	AD, TGE, PRCV, PRRS, SI
2015	2 141	568	3 764	993	280	0	0	AD, TGE, PRCV, PRRS, SI, PED
2016	2 180	564	3 824	952	271	0	0	AD, TGE, PRCV, PRRS, SI, PED
2017	1 955	548	3 804	695	225	0	0	AD, TGE, PRCV, PRRS, SI, PED
Total			124 549					

[1] Two samples from one herd were sero-positive for SI H3N2 in 1998 (probably infection from humans)
[2] One sero-positive sample for PRCV in 2005 (probably unspecific reaction).

Table 3. Number of herds tested and percentage of herds positive for H1N1pdm by county in 2017.

Region	Total herds	No. of herds tested	No. of herds tested positive	Percentage of herds tested positive (95% CI)
Finnmark/Troms/Nordland	108	27	2	7(1-26)
Trøndelag/Møre and Romsdal	376	133	48	36(28-45)
Hordaland/Sogn and	129	18	3	17(4-42)
Rogaland/Agder	592	159	103	65(57-73)
Buskerud/Vestfold/Telemark	182	69	16	23(14-35)
Oslo/Akershus/Østfold	199	56	15	27(17-41)
Hedmark/Oppland	369	86	38	44(34-55)
Total	1955	548	225	41(37-46)

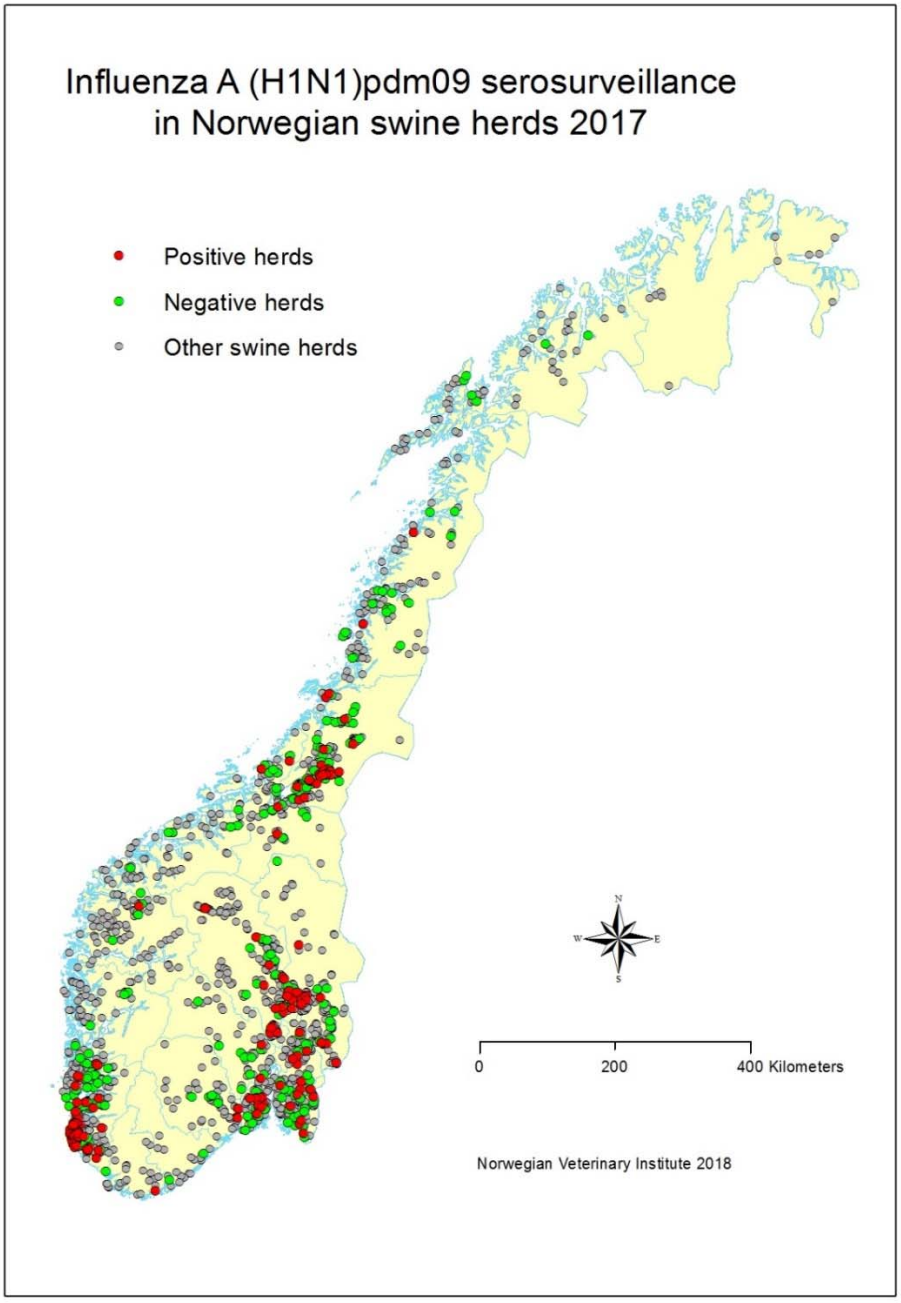

Figure 1. Serological results and geographical distribution of swine herds tested for antibodies against influenza A virus in the surveillance programme for specific viral infections in 2017.

Except for the outbreak of swine influenza caused by H1N1pdm in October 2009 and a detection of influenza H3N2 in a single herd during 1998, no viral infections under this surveillance programme have ever been detected either by clinical findings or by laboratory investigations. Studies have shown that the H1N1pdm virus was most likely introduced to pigs by humans infected with the same virus (2, 3). Under the routine surveillance programme in 2017, a total of 225 swine herds or 41 % of tested herds were positive for antibodies against H1N1pdm. The herd prevalence has fallen across all four production classes giving a lower national prevalence by 7% compared to 2016 (Table 1) but remained nevertheless above 40%. Interestingly, the decline was also in tandem with a much sharper drop in A H1N1pdm incidence in the human population in 2017(4). The decline, although nowhere as steep as in the humans, does suggest that reverse zoonosis may have contributed to a proportion of new infections in pig herds during previous years when H1N1pdm was the dominant human influenza strain in Norway. Geographically (Table 3), herd

prevalence had also fallen in most regions except the Rogaland/Agder region. Not surprisingly, the herd prevalence in Rogaland/Agder region, the densest pig farming area in Norway, remained highest and unchanged from last year thus suggesting an endemic situation sustained by continued high infection pressure in this region.

The surveillance in 2017 showed that Norway continued to be free from other influenza A subtypes that are endemic in most pig producing countries.

Swine influenza A H1N1pdm infection in Norwegian pig herds have mainly been subclinical or with mild clinical signs in a small proportion of the herds (2, 5, 6). A longitudinal study from a Norwegian boar testing station published in 2014 showed that infected growing pigs had reduced feed efficiency due to poorer feed conversion ratio and as such increase the time to market (7).

The Norwegian swine production has recent years had stabilization in the number of herds, while the average herd size is increasing. The pork production by tonnage has remained relatively stable. Due to changes in the sampling procedure for conventional herds with sows in 2011, the fraction of the total pig herd population sampled increased from 19 % in 2010 to 31 % in 2011. Since 2014, this proportion has been between 29% and 26%, while the mean number of samples per herd decreased.

Farmed wild boars and pigs kept as pets were not included in the programme, however these populations are very small and with little to no contact with the commercial pig population. There is a small, but increasing wild boar population in a local area along the Swedish boarder in the South-East of Norway.

Apart from AD, the EU has not approved additional guarantees (safeguards) against other swine viral infections when importing pigs into Norway. To protect the swine population against disease-related risks, Norway has its own national guidelines for the trade of live swine and pork products.

In conclusion, the surveillance programme for specific viral infections in 2017 demonstrates that Norwegian pig herds remained free from several serious infectious diseases, hence documenting Norwegian pig herd's favourable health status.

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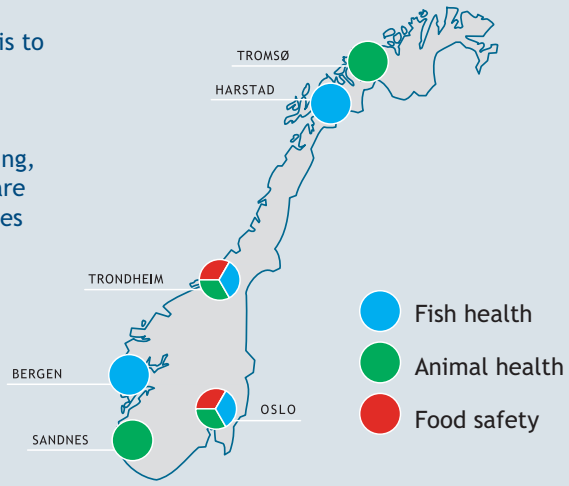

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