

## The surveillance programme for specific virus infections in swine herds in Norway 2014

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# The surveillance programme for specific viral infections in swine herds in Norway 2014

Carl Andreas Grøntvedt, Siri Kulberg Sjurseth, Chiek Er

**The surveillance programme for specific viral infections in swine herds in 2014 continued to show Norway to be free from Aujeszky's disease, transmissible gastroenteritis, 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. Although 48% (95% CI 46 - 50%) of the 622 herds sampled were seropositive against H1N1pdm during the surveillance in 2014, the Norwegian swine population was tested negative for other strains of the influenza A virus.**

## Introduction

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, porcine epidemic diarrhoea (PED) was also included in the programme (Table 1).

**Table 1.** Monitoring of the Norwegian swine population for antibodies against 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 2014.

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	1112	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 <sup>1</sup>	1 <sup>1</sup>	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 <sup>2</sup>	1 <sup>2</sup>	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
<b>Total</b>			113,157					

<sup>1</sup> Two samples from one herd were sero-positive for SI H3N2 in 1998 (probably infection from humans)

<sup>2</sup> One sero-positive sample for PRCV in 2005 (probably unspecific reaction).

The Norwegian Food Safety Authority coordinated the programme and collected the samples, while the Norwegian Veterinary Institute was responsible for the surveillance design, laboratory analyses and the reporting of the results.

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 maintain this favourable situation. The program also monitors the status of H1N1pdm infection in the Norwegian swine population.

## Materials and methods

### Herds and sampling

All the 97 nucleus and multiplying herds as well as the nucleus units of all 14 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 16 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 60 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 program 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<sup>®</sup> 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 Svanovir (SVANOVIR<sup>®</sup> 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 Antibody Test), 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 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 ID.vet (ID Screen® Influenza A Antibody Competition multi-species) were 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 test (HI), for the detection of antibodies against the H1N1pdm09 and European H1N1, H1N2 and H3N2 serotypes according to the method 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.

## Results

Blood samples from 4,083 individual pigs representing 622 herds were received by our laboratory (Table 1). The distribution of sampled herds in relation to production type is given in Table 2. Only a few samples were rejected (Table 3). The mean number of animals tested per farm was 7 (range 1 - 46).

Of the 622 tested herds, 47.6 % were seropositive for H1N1pdm. The proportion of herds tested positive by region varied from 1% in the aggregated counties of Hordaland/Sogn and Fjordane to 70% in the counties of Rogaland and Agder (Table 4).

**Table 2.** Distribution of swine herds in the surveillance programme 2014 according to type of production and the results for antibodies to H1N1pdm.

Category	No. of herds sampled	Total no. of individual samples collected	No. of positive herds H1N1pdm	Percentage positive H1N1pdm
Nucleus herds and multiplying herds	97	1,271	51	52.6%
Sow pools	14	271	12	85.7%
Integrated and piglet-producing herds	466	2,070	228	48,9%
Fattening herds	45	471	5	11.1%
<b>Total</b>	<b>622</b>	<b>4,083</b>	<b>296</b>	<b>47.6%</b>

**Table 3.** Number of samples submitted and their results for AD, swine influenza, and PRRS, PRCV and TGE in 2014.

Disease	Samples				Herds	
	Received	Rejected	Negative	Positive	Negative	Positive
AD	4,083	1	4,082	0	622	0
SI (H1N1pdm)	4,083	1	2,944	1,138	326	296
SI (H1N1, H3N2, H1N2)	4,083	2	4,081	0	621	0
PRRS	4,083	1	4,082	0	622	0
TGE	4,083	5	4,078	0	622	0
PRCV	4,083	5	4,078	0	622	0

**Table 4.** Number of herds tested and percentage of herds positive for H1N1pdm by regions in 2014.

Region	Total herds	No. of herds tested	No. of herds tested positive	Percentage of herds tested positive (95% CI)
Finnmark/Troms/Nordland	143	42	11	26 (19-33)
Trøndelag/Møre and Romsdal	392	153	76	50 (45-55)
Hordaland/Sogn and Fjordane	132	19	1	5 (2-9)
Rogaland/Agder	601	177	124	70 (66-74)
Buskerud/Vestfold/Telemark	220	80	22	28 (22-33)
Oslo/Akershus/Østfold	216	59	21	36 (29-42)
Hedmark/Oppland	413	92	41	45 (40-49)
<b>Total</b>	<b>2,117</b>	<b>622</b>	<b>296</b>	<b>48 (46-50)</b>

## Discussion

The results from the surveillance programme in 2014 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.

Except for the outbreak of swine influenza caused by H1N1pdm in October 2009, no viral infections under this surveillance programme have ever been detected either by clinical findings or 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 2014, a total of 296 swine herds or 48 % of tested herds were positive for antibodies against H1N1pdm. Comparing this figure with 46% in 2013, 49 % in 2012, 48 % in 2011 and 41% in 2010 shows that influenza caused by H1N1pdm virus has become endemic in the Norwegian pig population. The surveillance in 2014 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, 4, 5). A longitudinal study from a Norwegian boar testing station published in 2014 showed that infected growing pigs had reduced feed conversion efficiency and as such increase the time to market (6).

The Norwegian swine production continued with the trend of herd numbers declining, while the average herd size is increasing. The pork production by tonnage however, 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 and 34 % both in 2012 and in 2013, while the mean number of samples per herd decreased.

Farmed wild boars and pigs kept as pets were not included in the programme. There is a very small wild boar population in a local area along the Swedish boarder in the South-East of Norway.

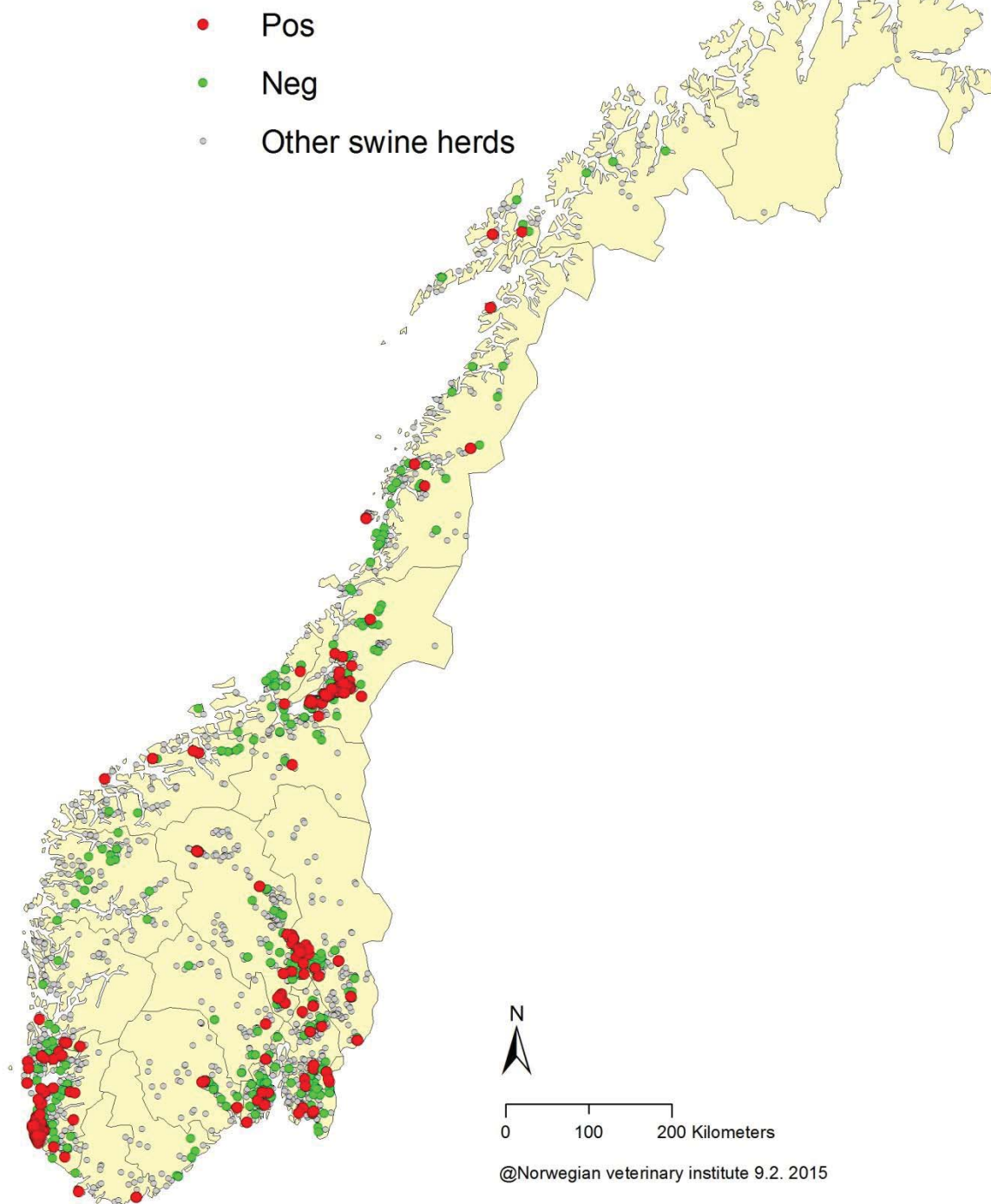
Apart from AD, the EU has not approved additional guarantees (safeguards) against other swine viral infections when importing pigs into Norway. To protect its swine population against disease-related risks, Norway has its own national guidelines for the trade of live swine and pork products.

In conclusion, the surveillance programme for specific viral infections in 2014 provided more evidence that demonstrates Norwegian pig herds remained free from several serious infectious diseases, hence documenting Norwegian pig herd's favourable health status.

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## Swine influenza A(H1N1)pdm09 surveillance 2014



**Figure 1.** Serological results and geographical distribution of swine herds tested for influenza A in the surveillance programme for specific viral infections in 2014.

The Norwegian Veterinary Institute (NVI) is a nationwide research institute in the fields of animal health, fish health, and food safety. The primary mission of the NVI is to give research-based independent advisory support to ministries and governing authorities. Preparedness, diagnostics, surveillance, reference functions, risk assessments, and advisory and educational functions are the most important areas of operation.

The Norwegian Veterinary Institute has its main laboratory in Oslo, with regional laboratories in Sandnes, Bergen, Trondheim, Harstad og Tromsø, with about 360 employees in total.

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The NFSA comprises three administrative levels, and has some 1300 employees.

The NFSA advises and reports to the Ministry of Agriculture and Food, the Ministry of Fisheries and Coastal Affairs and the Ministry of Health and Care Services.

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