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

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*The surveillance and control programme for specific virus infections in swine herds in 2010 continued to show that Norway is 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, pandemic influenza A (H1N1) 2009 virus (H1N1pdm), in 2009. Although the surveillance in 2010 showed that swine in 41 % of the 459 randomly selected herds had antibodies against H1N1pdm, the Norwegian swine population continued to be tested free from other strains of the influenza A virus.*

## Introduction

The national surveillance and control 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 2010. Herd numbers were based on the registry as per 31. July 2010.

Year	Herds in population	Herds tested	Animals tested	Animals positive	Herds positive	Diseases included
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, PED,
1998	6,275	491	4,695	2 <sup>1</sup>	1	AD, TGE, PRCV, PRRS, PED,
1999	5,761	470	4,705	0	0	AD, TGE, PRCV, PRRS, 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	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 <sup>3</sup>	20	AD, TGE, PRCV, PRRS, SI
2010	2,441	459	4,250	940 + 1 <sup>4</sup>	189	AD, TGE, PRCV, PRRS, SI
<b>Total</b>			<b>94,362</b>			

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

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

<sup>3</sup> 131 samples from 20 herds were sero-positive for the H1N1pdm.

<sup>4</sup> 940 samples from 189 herds were sero-positive for the H1N1pdm while one sample was sero-positive for European H1N1 only. The herd of this latter positive result was retested by taking samples from 20 sows, including the positive sow. All were negative for influenza A.

The Norwegian Food Safety Authority was responsible for running the programme, while the Norwegian Veterinary Institute was responsible for planning, laboratory analyses and reporting.

The EFTA Surveillance Authority (ESA) has recognised Norway's disease-free status for AD since July 1 1994, and has laid down additional measures in the trade of pigs and pork to protect Norway's Disease free status for AD. The additional measures are described in ESA Decision 75/94/COL, amending ESA Decision 31/94/COL, later replaced by ESA Decision 226/96/COL.

## Aims

The aims of the serological surveillance programme are to ascertain the continued absence of specific infectious diseases in the Norwegian swine population and to maintain this favourable situation.

## Materials and methods

### Herds and sampling

All the 127 nucleus and multiplying herds were included in the programme. In addition, the nucleus units of all the 14 sow pools and a random selection of the remaining swine herds were included in the programme. The random selection was conducted for all swine herds receiving governmental production subsidies. According to the records of 31 July 2009, there were 2,552 commercial swine herds registered. From these, 300 integrated and piglet-producing herds and 60 fattening herds were selected.

The counties Østfold, Akershus, Vestfold and Rogaland were considered to be "high risk areas" and a relatively larger proportion of farms from these counties were selected. Areas are considered 'high risks' where there are relatively higher density of pig herds, closer geographically to Denmark or Sweden and more human traffic between Norway and these countries.

Samples were collected at the farms, except for the fattening herds, which were collected at six different abattoirs. The default sample size from each herd was ten pigs.

### Laboratory analyses

All the serological analyses were performed at the Norwegian Veterinary Institute in Oslo. All inconclusive or positive samples in the routine tests were re-tested with specified reference tests.

### Aujeszky's disease

All serum samples were tested for antibodies against AD virus using a commercial blocking ELISA (SVANOVIR™). The test detected antibodies against glycoprotein B (previously glycoprotein II) found on the surface of the virus. Positive or dubious results are retested with the SVANOVIR™ PRV-gE.

### Transmissible gastroenteritis virus and porcine respiratory coronavirus

A combined blocking ELISA (SVANOVIR™) was used to detect antibodies against TGEV/PRCV. This ELISA test makes it possible to differentiate between antibodies against TGEV and PRCV, respectively, in serum samples.

### Porcine reproductive and respiratory syndrome

All serum samples were tested for antibodies against PRRS virus using the HerdChek PRRS 3XR Antibody Test Kit (IDEXX) which detects the most predominant European and American strain of PRRS viruses. In the case of dubious or positive results, the samples were re-tested at the National Veterinary Institute Technical University of Denmark by using blocking ELISAs and immune-peroxidase tests (IPT).

## Swine influenza

To test for swine influenza, the serum samples were initially tested using an ELISA kit (ID Screen® Influenza A Antibody Competition test, IDVET) that was designed to detect anti-Influenza A specific antibodies in pigs. If the results were positive or doubtful, the serum samples were re-examined using the hemagglutination-inhibition (HI) assays for antibodies against the H1N1pdm and European H1N1, H1N2 and H3N2 serotypes according to the method described in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (1). The antigens for the tests were produced at the Norwegian Veterinary Institute.

## Results

The distribution of tested herds in relation to type of production is given in Table 2. The mean number of animals tested per farm was 9 (range 1 - 25). The geographical distribution of investigated farms was in accordance with the spatial distribution of the total swine herd population (Figure 1).

Table 2. Distribution of swine herds in the surveillance and control programme 2010 according to type of production

Category	No. of herds tested	Total no. of individual samples collected
Nucleus herds and multiplying herds	120	1,203
Sow pools	13	131
Integrated and piglet-producing herds	277	2417
Fattening herds	49	599
<b>Total</b>	<b>459</b>	<b>4,250</b>

Blood samples from 4,250 individual animals from 459 herds were submitted and the results are shown in Table 3.

Table 3. Number of samples submitted and their results for AD, swine influenza, and PRRS, PRCV and TGE in 2010

Disease	Samples				Herds	
	Received	Rejected	Negative	Positive	Negative	Positive
AD	4,250	0	4,250	0	459	0
SI	4,250	2	3,307*	941	270	189
PRRS	4,250	1	4,249	0	459	0
TGE	4,250	3	4,247	0	459	0
PRCV	4,250	3	4,247	0	459	0

\* Negative includes 33 individual samples where the result was characterised as uncertain.

Of the randomly selected 459 herds tested, 41% were sero-positive for H1N1pdm. The proportion of herds testing positive by region varied from 21% in the counties Hordaland and Sogn and Fjordane to 57% in the counties Rogaland and Agder. Table 4 shows that regions with more swine herds also had higher proportion of herds tested positive for H1N1pdm.

One sample was sero-positive for European H1N1 only. Additional samples from 20 sows, including the sow with positive sero-positive reaction, were collected from the same herd three months later were all tested negative for influenza A. Therefore, it was concluded that the result was a false positive.

Table 4. Number of herds tested and percent of herds positive for H1N1pdm by regions

Counties	Total herds	No. of herds tested	Number (%) of herds tested positive	95% CI
Finmark/Troms/Nordland	166	25	6 (24%)	9 - 39
Trøndelag/Møre and Romsdal	490	88	47 (53%)	45 - 64
Hordaland/Sogn and Fjordane	162	24	5 (21%)	6 - 36
Rogaland/Agder	687	129	73 (57%)	49 - 64
Buskerud/Vestfold/Telemark	237	59	20 (34%)	23 - 45
Oslo/Akershus/Østfold	257	69	20 (29%)	20 - 38
Hedmark/Oppland	442	65	18 (28%)	18 - 38
<b>Total</b>	<b>2441</b>	<b>459</b>	<b>189 (41%)</b>	<b>37 - 45</b>

## Discussion

The results from the surveillance and control programme in 2010 showed that Norway has maintained its disease freedom status for AD, TGE, PRCV and PRRS virus infections in the national swine population since the surveillance started in 1994 (2).

Before the outbreak of swine influenza caused by H1N1pdm in October 2009, there have never been any clinical records that indicated the presence of the specific viral infections included in this surveillance and control programme. A total of 189 or 41% (95% confidence interval of 37% - 46%) of swine herds were sero-positive for H1N1pdm under the routine surveillance and control programme by the end of 2010 indicating a very rapid spread of the H1N1pdm infection in the Norwegian pig population (3, 4). The spread as seen from graph (figure 1) was disproportionate by geographical regions. Regions with higher number of pig farms also have higher prevalence for the disease. On the bright side, the surveillance in 2010 showed that Norway continued to be free from other influenza A subtypes that were endemic in most pig producing countries.

The Norwegian swine industry continued with the trend of herd numbers declining, while average herd size increased. The pork production by tonnage however, has remained relatively stable. The fraction of the herd population sampled each year increased slightly from 14.3 % in 1994 to 18.8 % in 2010.

Farmed wild boars and pigs kept as pets were not included in the programme. There were no wild boar population registered in Norway. However, a few wild boards could occasionally cross the border from Sweden.

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 trade of live swine and pork products.

In conclusion, the surveillance and control programme for specific virus infections in 2010 provided good evidence that the health situation in Norway's swine population continued to be favourable with the population being free of several serious infectious diseases. Despite the recent introduction of swine influenza H1N1pdm, the economic impact of this disease on swine production appeared to be minimal as evidenced by the low morbidity. Targeted surveillance and research work will continue to monitor how the H1N1pdm virus will evolve, and its clinical and economic impact on the Norwegian pig population.

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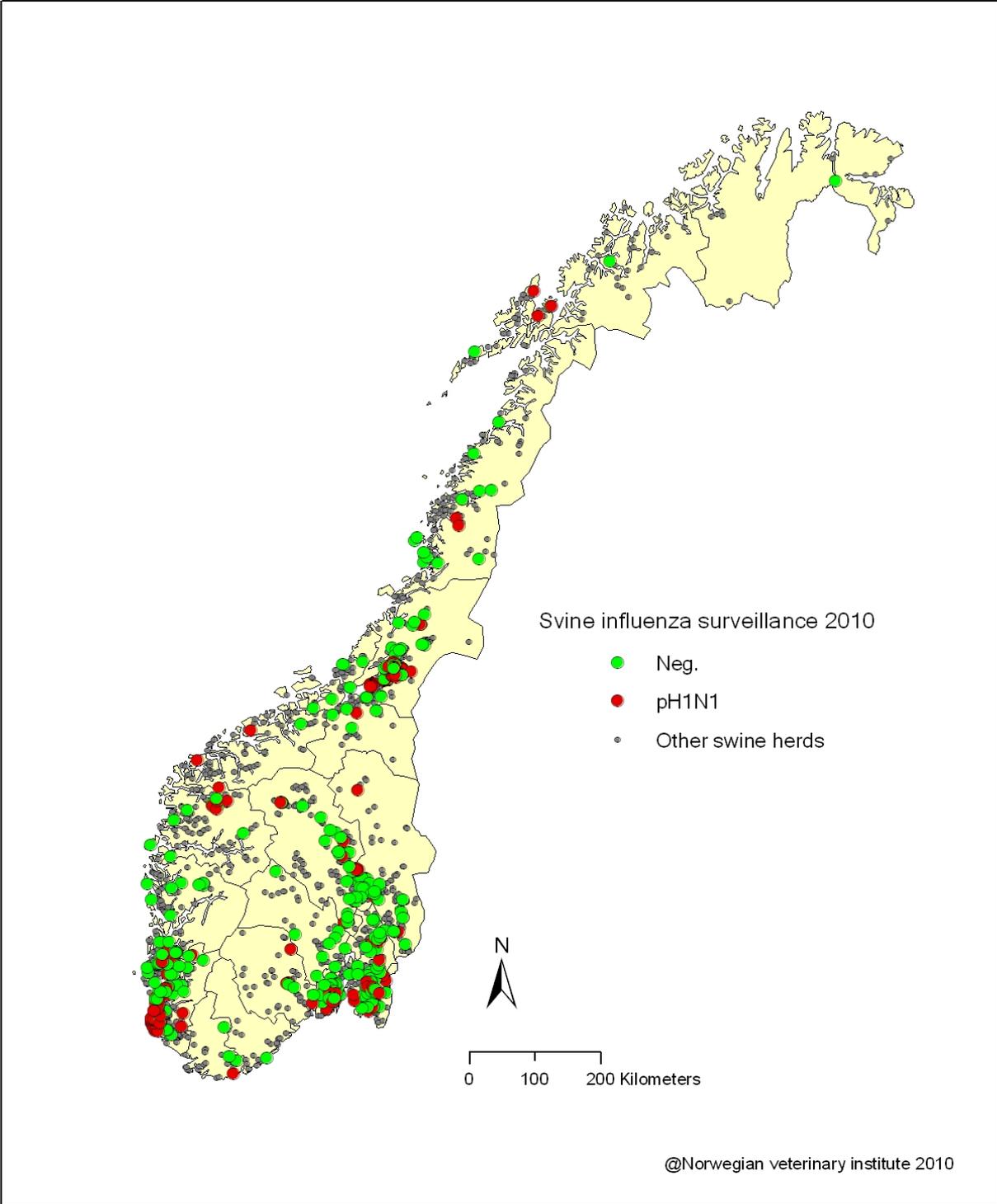
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Figure 1. Serological results and geographical distribution of swine herds tested for influenza A in the surveillance and control programme for specific virus infections in 2010.





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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