January 11th and 12th, 2017, Campus Adamstua, Oslo, Norway

# NKVet Symposium

# 2017

## Control- and surveillance programs for health and welfare in production animals

NK Vet

Nordic Committee for Veterinary Scientific Cooperation

# Welcome

NKVet, The Nordic Committee for Veterinary Scientific Cooperation, is pleased to welcome you all to this symposium on Control- and surveillance programs for health and welfare in production animals at Campus Adamstua in Oslo.

NKVet has worked to promote inter-Nordic collaboration in the fields of animal health, welfare and science the last 30 years. There is a "Nordic model" for handling issues related to these aspects - minimal use of antibiotics, high standards for health and welfare, and national control and surveillance programs.

The current symposium aims to describe and discuss some of the surveillance programs for health and welfare in place today, and what role such programs will have in the future.

Day one will finish with a celebration of a successful way to handle risk associated with import of live animals and breeding material. KOORIMP – The Norwegian Livestock Industry's Biosecurity Unit was founded twenty years ago. Through these years, surveillance and disease knowledge have been important for advising importers about risk handling, in Norway but also in the other Nordic countries.

We hope the symposium will give insight and inspiration for future work, and lay a basis for further collaboration between the Nordic countries.

**Programme Committee**
Nina Svendsby (Chair)
Petter Hopp
Linda Keeling
Ulla Rikula
Eggert Gunnarsson
Kristian Møller

**Organising committee**
Tore Skeidsvoll Tollersrud (Norwegian Veterinary Institute)
Petter Hopp (Norwegian Veterinary Institute)
Nina Svendsby (Animalia)
Pia Vennerström (EVIRA)

# Content

# Program

Wednesday 11.01.2017

09:00 – 10:00 Registration

10:00 Welcome – Tore Tollersrud

10:15 – 12:00 Current surveillance programs in animal health and welfare in the Nordic countries. Moderator: Pia Vennerström

10:15 – 10:45: "Monitoring animal health today and future perspectives", Petter Hopp
10:45 – 11:00: "Surveillance for Chronic Wasting Disease in cervids in Norway", Ståle Sviland
11:00 – 11:30: "Monitoring animal welfare today and future perspectives", Linda Keeling and co-authors Jan Hultgren and Harry Blokhuis
11:30 – 11:50: "Syndromic surveillance", Fernanda Dórea
11:50 – 12:00: Questions and views

**12:00 – 13:00 Lunch and posters**

13:00 – 14:30 The role of the industry vs. the authorities – cooperation or competition? Moderator: Tore Tollersrud

13:00 – 13:45: "Understanding roles - to have the same goal and different hats", Kristina Landsverk
13:45 – 14:00: Questions and views
14:00 – 14:30: "Animal Welfare regulations", Frida Lundmark and co-author Lotta Berg

**14:30 – 15:00 Coffee break**

15:00 – 15:45 Authorities vs industry continues

15:00 – 15:20: "Consumers preferences and the marketing of good animal welfare" Marianne Kulø
15:20 – 15:45: Discussion – panel debate

**15:45 – 16:00: Break**

16:00 – 17:00 KOORIMP 20 år, vi feirer risikohåndtering i praksis. Moderator: Nina Svendsby

16:00 – 16:20: "Starten", Trygve Grøndalen (gründer)
16:20 – 16:40: "Det nordiske samarbeidet" Hannele Nauholz
16:40 – 17:00: "Risikovurdering import av storfe fra 7 land", Tormod Mørk

**17:00 – 17:30:** Celebration with bubbling drinks

**19:00 - 23:00 Dinner**

På Olympen Restaurant, www.olympen.no

## Thursday 12.01.2017

### 09:00 – 10:00 New methods of surveillance. Moderator: Petter Hopp

09:00 – 09:40: “Efficient methods, health and welfare”, Jenny Frössling

09:40 – 10:15: “Ongoing animal health and welfare projects – Nordic and arctic veterinary authority collaboration”, Thora Jónasdottir

**10:15 – 10:40: Coffee break**

### 10:40 – 12:30 New Methods continues

10:40 – 11:00: “Passive surveillance of VHS genotype Id in brackish water rainbow trout farms was superior to active surveillance”, Pia Vennerström

11:00 – 11:20: “Optimising targeted surveillance for bovine virus diarrhoea”, Malin Jonsson

11:20 – 11:40: “Big data - modelling of midges in Europa by machine learning”, Lene Jung Kjær

11:40 – 12:00: “Assessment of animal welfare in broiler flocks”, Randi Oppermann Moe and co-authors Guro Vasdal and Erik Granquist

12:00 – 12:30: Panel debate

**12:30 – 13:30 Lunch**

### 13:30 – 15:00 “One health” Moderator: Lotta Berg

13:30 – 14:00: “One health, utilization of data for improved lives in humans and animals”, Yngvild Wasteson

14:00 – 14:20: “Risk based surveillance of vector borne infections”, Rene Bødker

14:20 – 14:40: “MRSA Research in Denmark – a close collaboration between the animal and human side”, Professor Karl Pedersen

14:40 – 15:00: MRSA – surveillance and control in Norway, Carl Andreas Grøntvedt

15:00 – 15:15: Questions and closing comments

# NKVet

NKVet, The Nordic Committee for Veterinary Scientific Cooperation, was founded in 1977 by the five Nordic Veterinary Associations.

NKVet aims are to promote increased veterinary research cooperation between veterinarians and researchers within the Nordic countries by organising meetings on topics within veterinary sciences relevant for a broad Nordic audience including scientists, veterinarians, decision makers and stakeholders.

The symposia have been open to all and the proceedings are published. Since 1995, the official language of the symposia and the proceedings has been English and are therefore available for participants from outside the Nordic region, in particular the Baltic countries, and facilitated the invitation of experts from countries outside the Nordic countries.

NKVet is administered by a Board consisting of members from the Nordic countries. The Board members are nominated among employees at the veterinary universities and national veterinary institutes, and elected by their respective national veterinary associations. The work they perform for the NKVet is based on voluntary work and no compensation, except travel expenses to board meetings, is paid by the NKVet. The Board meets twice a year, normally in conjunction with the annual symposia

**NKVet Board**
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Thorsteinn Ólafsson, Iceland
Arvid Uggla, Sweden
Pia Vennerström, Finland (secretary)
Pirkko Nousiainen, Finland (treasurer)

# NKVet symposia

1. Animal Disease in Relation to Breeding (Norway 1977)
2. Modern Immune Therapy and Prophylaxis (Sweden 1979)
3. Herd Health Problems and Diagnostic (Denmark 1981)
4. Prenatal Veterinary Medicine (Finland 1985)
5. Ethical Aspects in the Animal Production (Denmark 1989)
6. Meat Control in a Modern Perspective (Norway 1991)
7. The Veterinarian and the Environment (Sweden 1992)
8. Slow Virus Infections (Iceland 1994)
9. Decision of Vaccination Strategy in Relation to Increased Trade of Animals and Animal Products (Copenhagen 1995)
10. Effects of International Trade on Animal Health, Public Health and Animal Welfare in the Nordic Countries (Finland 1996)
11. Antibiotic Resistance (Norway 1997)
12. Antimicrobial Policy - What Does It Mean in Every-day Work (Finland 1998)
13. National Disease Control in Farmed Animals (Sweden 1999)
14. Challenges in Organic Farming (Iceland 2000)
15. Paratuberculosis Eradication or Acceptance (Denmark 2001)
16. Xenotransplantation - Animal Organs to Save Human Lives (Norway 2002)
17. Animal Transports - Disease Risks and Welfare Aspects(Finland 2003)
18. Emerging Zoonoses - New Challenges (Sweden 2004)
19. Prevention of Boar Taint in Pig Production (Norway 2005)
20. Perinatal Death in Domestic Animals (Iceland 2007)
21. The role of the Veterinarian in Animal Welfare (Denmark 2007)
22. Parasite infections of domestic animals in the Nordic countries-emerging threats and challenges (Finland 2008)
23. Use and misuse of drugs in the athletic horse ( Sweden 2009)
24. Databases in veterinary meicine -Validation, harmonisation and application (Denmark 2010)
25. Bluetongue in the Nordic countries (Norway 2010)
26. Environmental contamination and animal health (Finland 2011)
27. Pain assessment and treatment in clinical practice (Sweden 2012)
28. Mastitis-new knowledge on diagnostics and control on modern dairy farms (Iceland 2013)

**NKVet has additionally co-operative in arranging the following three symposia:**

- Research in Ethology and Animal Production (Denmark 1983)
- Aquaculture (Norway 1984)
- Hormones as Growth Promoters - Use, Risks and Control (Sweden 1992

# Participants

| | | |
|---|---|---|
| Berg | Lotta | Swedish University of Agricultural Sciences |
| Bødker | Rene | DTU National Veterinary Institute |
| Dórea | Fernanda | Swedish National Veterinary Institute |
| Eskola | Anna | POSA |
| Freed | Ylva | Norsk Fjørfelag |
| Frössling | Jenny | Statens Veterinärmedicinska Anstalt SVA /SLU |
| Godli | Olaf | Norges Bonde- og Småbrukarlag |
| Grøndalen | Trygve | KOORIMP |
| Grøntvedt | Carl Andreas | Norwegian Veterinary Institute |
| Guarracino | Mario | Norwegian Veterinary Institute |
| Gulbrandsen | Bjørn | Geno SA |
| Gulliksen | Stine Margrethe | Animalia |
| Hanssen | Ida Marie | Mattilsynet |
| Heikinheimo | Annamari | University of Helsinki |
| Hofmo | Peer Ola | Norsvin SA |
| Hopp | Petter | Norwegian Veterinary Institute |
| Høier Olsen | Lisbeth | NKVet, University of Copenhagen |
| Jarp | Jorun | Norwegian Veterinary Institute |
| Jónasdóttir | Thóra Jóhanna | Icelandic Food and Veterinary Authority |
| Jonsson | Malin | Norwegian Veterinary Institute |
| Jung Kjær | Lene | National Veterinary Institute, Technical University of Denmark |
| Jörundsson | Einar | Institute for experimental pathology, Keldur |
| Kampen | Annette | Norwegian Veterinary Institute |
| Karlsen | Odd Magne | Nortura |
| Keeling | Linda | Swedish University of Agricultural Sciences |
| Kittelsen | Käthe | Animalia |
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| Kulø | Marianne | Dyrevernalliansen |
| Kummen | Eiliv | Geno Norway |
| Landsverk | Kristina | Norwegian Food Safety Authority |
| Lagesen | Karin | Norwegian Veterinary Institute |
| Lillehaug | Anja | Bondelagets Servicekontor |
| Lindheim | Dag | TINE Rådgiving |
| Liste | Josie | PP |
| Lundmark | Frida | Swedish University of Agricultural Sciences |
| Lyngstad | Trude Marie | Norwegian Veterinary Institute |
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| Mørk | Tormod | Norwegian Veterinary Institute |
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| Nafstad | Ola | Animalia |
| Nauholz | Hannele | Animal Health ETT |
| Norström | Madelaine | Norwegian Veterinary Institute |
| Nødtvedt | Ane | NMBU - Veterinærhøgskolen |
| Odden | Helga | Animalia |

| | | |
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| Oma | Veslemøy | NMBU - Veterinærhøgskolen |
| Pedersen | Karl | Technical University of Denmark |
| Pedersen | Lars | SEGES |
| Rattenborg | Erik | SEGES |
| Rikula | Ulla | Evira |
| Ruud | Tor Arne | Animalia |
| Salzano | Silvia | Animalia |
| Sihvonen | Liisa | Evira |
| Sjurseth | Siri | Norwegian Veterinary Institute |
| Staaf Larsson | Birgitta | Swedish Univ. of Agricultural Sciences |
| Steen | Margareta | Swedish Univ. of Agricultural Sciences |
| Stenklev | Eli Maria | Nortura |
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| Svendsby | Nina | Animalia |
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| Tollersrud | Tore Skeidsvoll | Animalia |
| Tolo | Elisiv | Animalia |
| Uggla | Arvid | Swedish Univ. of Agricultural Sciences |
| Vasdal | Guro | Animalia |
| Vatn | Synnøve | Animalia |
| Vennerström | Pia | Evira |
| Villand Lindheim | Britt Helene | Mattilsynet |
| Wasteson | Yngvild | NMBU - Veterinærhøgskolen |
| Whist | Anne Cathrine | Tine Rådgiving |

# Abstracts

## Monitoring animal health today and future perspectives

Petter Hopp

Norwegian Veterinary Institute, P.O. Box 750 Sentrum, NO-0106 OSLO, Norway

Monitoring animal health and animal health surveillance is essential for the early detection, prevention and control of infectious diseases in aquatic and terrestrial animal production. It is consequently a key task in maintaining and improving animal health, productivity and safe trade of production animals and their products.

The Nordic countries has established surveillance programmes for many infections in several animal species. These surveillance programmes have partly been established due to international regulations, others as part of national requirements. They are run by the Government or the Industry and serves several purposes like early detection, documenting freedom from infection and control of or eradication of infection.

Traditionally, animal health surveillance has been performed by collecting a statistically sufficient number of randomly selected samples. However, risk based sampling (i.e. selecting samples form animals/population having a higher probability of having disease) is used more and more. Also unspecific surveillance methods like syndromic surveillance is established.

The way animal health surveillance is performed today, is confronted with several challenges and demands. New diseases continue to emerge and known diseases (re-)emerge into new populations and geographical areas, further promoted by increased globalisation and climate change. There is an increasing demand for documentation of freedom from disease using scientifically accepted methods to ensure global recognition, fair and safe trade. Authorities and the industry request more cost-efficient methods to create more information and knowledge from surveillance data.

There will be an increased use of risk based sampling to reduce costs. This is supported by the Animal Health Law adopted in March 2016, which focuses on prevention and control measures using a risk-based approach. Furthermore, the use of unspecific surveillance (like syndromic surveillance) will be increasingly used and more experience will be gained in its usefulness for detecting emerging diseases. The use of information from the increasing volumes of electronically stored data on animal populations, health records, management data from automatic milking systems, genetic sequences, weather data etc. can potentially make it easier to identify individuals and populations with a higher probability of having disease. But are also posing new challenges regarding data management, processing and analysis due to the huge amounts and/or complexity data (big data). Evaluation of the surveillance programmes will be even more important to obtain cost-efficient programmes with low administrative burden.

## Surveillance for Chronic Wasting Disease in cervids in Norway

Ståle Sviland, Norwegian Veterinary Institute P.O. Box 750 Sentrum, NO-0106 OSLO, Norway

In April 2016 the Norwegian Veterinary Institute (NVI) diagnosed chronic wasting disease (CWD) in a 4 year old female free ranging reindeer located in the mountain area of Nordfjella. This animal was the first case of CWD in Europe and the first case in free ranging reindeer in the world. In May and June two moose was brought in to the NVI in Trondheim for necropsy. Both animals were infected with CWD prionprotein. The two moose were found in the same municipality of Selbu in the county of Sør Trøndelag. The distance between the two locations in Nordfjella and in Selbu is approximately 300 km.

The three CWD-cases resulted in a comprehensive surveillance programme of the cervid population in Norway beginning in august 2016 and lasted throughout the rest of the year. A close collaboration between the Norwegian Food Safety Authority (NFSA), the Norwegian Veterinary Institute, the Norwegian Institute for Nature Research, (NINA) and the Norwegian Environmental Agency was a premise for success in this programme.

The hunting seasons in both the reindeer district of Nordfjella and in the region of Trøndelag had a particular focus regarding sampling of brains from the majority of hunted cervids older than one year of age. However, samples from hunted cervids all over the country were collected and analyzed in addition to sampling of cervids regarded as risk population, like sick or injured cervids and animals found dead. Captive reindeer, especially in the southern part of Norway, and captive deer were sampled during the slaughter season.

**Results**

More than 10,000 cervids have been tested for CWD in 2016, whereas 2580 samples originated from reindeer (1700 samples from captive reindeer), 2594 samples came from deer (146 samples from captive deer), 4400 moose and 480 row deer were also included in the surveillance programme. Brain samples from cervids were collected from every county in Norway but the number of samples related to the different cervid populations was not proportionally distributed. Eleven percent of the samples from moose came from sick, injured or dead animals. Corresponding figures for free ranging reindeer, deer and row deer were 36%, 9% and 90%, respectively.

Among 354 examined reindeer in the district of Nordfjella two more hunted reindeer with CWD prionprotein were revealed in the programme. The prevalence of CWD-positive animals of sampled reindeer in Nordfjella was 0.8% including the index case. In the region of Trøndelag 646 moose were analyzed for CWD. No more positive brain samples from moose were found in the programme. This means that the CWD prevalence in sampled moose was 0.3%.

## Monitoring animal welfare today and future perspectives

Linda Keeling, Jan Hultgren and Harry Blokhuis

Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Sweden.

Routine monitoring of farm animal welfare is already well established in many countries as part of e.g. official control, industry management programmes and quality assurance schemes, but research on the methodology around it is lagging behind that related to monitoring animal disease. Nevertheless, the scenery is changing and some of the new developments in welfare assessment may even contribute to developments for disease monitoring, which up until now has mainly focussed on infectious disease. Animal health is an important part of animal welfare, although good health is more than the absence of disease. Most animal welfare assessment includes inspecting animals for evidence of problems related to their housing, feeding, health and their behaviour. The first future perspective that we will discuss is closer research collaboration, and perhaps even a merging of animal disease and welfare monitoring in practice.

Monitoring can focus on the conditions that are provided to the animals and what the person responsible for animals should (or should not) do, thus monitoring can help reduce the risk of problems based on what we know about how to keep and manage animals. Legislation specifies minimum requirements regarding resources (flooring, feed trough length, etc.) and how to manage the animals (provision of litter material, handling, weaning, feeding regimes, transport, etc.). This has been the traditional, prescriptive way to ensure good welfare. However, we cannot legislate on every detail and even correct 'inputs' (factors) do not always lead to the desired 'outcomes' (consequences). In fact, focus on this traditional approach has the negative effect of slowing progress towards innovative ways to achieve good welfare, focussing more on the animals themselves. Farmers are interested in the performance of their animals and base decisions about housing and management on how it affects their stock. Consumers are interested in the quality of the final product and whether the animals that produced it had good welfare. Thus there is a potential for more emphasis on outcome-based measures. The second future perspective we will discuss is therefore the trend towards a greater use of animal-based outcome measures, even in legislation, while acknowledging that the optimum balance between input and outcome measures depends on the purpose of the monitoring.

Economic and time constraints mean that monitoring and surveillance systems need to be as efficient as possible. Epidemiological research can help with this, but such analyses require data on both inputs and outcomes to investigate the strength of associations between them. If databases are to be merged, then the measures need to be standardised and the methods by which they are collected harmonised, which is rarely the case. At present research has focussed on the few existing databases and on incomplete data. Our third future perspective relates to the value of merging data from different sources, the development of animal welfare epidemiology and the benchmarking of indicators of animal welfare nationally and internationally.

In conclusion, we argue that is it no longer the lack of measures or methods related to animal welfare assessment that is the greatest hinder to progress, but a lack of harmonised implementation in practice and limited access to relevant reliable data. We are nevertheless optimistic about progress towards systems that safeguard a minimum level of welfare for the animals, while at the same time giving producers flexibility to innovate and go above this minimum.

## Syndromic surveillance: from early detection to comprehensive data-driven surveillance

Fernanda C. Dórea

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Syndromic surveillance emerged in public health in the early 2000's in response to the need for early disease detection, and promptly propelled by the fast growing field of health informatics. As the technology to analyse large amounts of data evolved, the search for datasets that could contain early signs of disease emergence lead to the use of "syndromic" data, which the Centers for Disease Control (CDC) defined as "health-related data that precede diagnosis and signal with sufficient probability of a case or an outbreak to warrant further public health response".

In animal health, syndromic surveillance started picking up speed in the early 2010's, but independent inventories of data sources used in animal health demonstrate that the data are hardly "syndromic". The most common data sources utilised lack actual clinical information that could lead to the characterisation of true syndromes (e.g. laboratory data), do not precede traditional diagnosis (e.g. abattoir data), or fail in both criteria (e.g. mortality counts without a recorded reason of death). On the other hand, much less specific sources of population data continuously recorded, such as production data, are available for animal surveillance, and start being explored for disease monitoring.

In the early 2010's a thorough review of syndromic surveillance initiatives in Europe, in the public and animal health domains – The Triple S project – offered a new definition of syndromic surveillance much more focused on the goals (early detection) and the methods (automated analysis), rather than the type of data used. The definition reads: "syndromic surveillance is the real-time (or near real-time) collection, analysis, interpretation and dissemination of health-related data to enable the early identification of the impact (or absence of impact) of potential human or veterinary public-health threats which require effective public health action".

In this presentation I review the methods behind syndromic surveillance, and argue that automated analysis of animal health related data can generate information that should support surveillance goals beyond early disease detection. Experience in Sweden has shown that new epidemics are more likely to be detected by humans – the veterinarians working in contact with the animal population daily – than by computers. Real-time information systems should therefore focus on supporting veterinarians and epidemiologists in preventing and controlling epidemics, rather than just detecting them. The technologies developed for syndromic surveillance so far can, and should be used to build smart systems of data-driven surveillance to support decision making in real time.

## Understanding roles - to have the same goal and different hats

Kristina Landsverk

CVO, Norwegian Food Safety Authority

Norway has a very good animal health, together with Iceland, maybe the best animal health in the world. If we use a metaphor from the finance world, you can resemble the animal health statues with an investment portfolio. The assets in the portfolio are freedom from diseases. In Norway's, case almost all the diseases on the OIE list and in addition a number of diseases which are classified as production diseases in many countries. The building of the portfolio has been going on for years. One of the first diseases that were fought with success was sheep scabies, psorptes ovis. In 1894 Norway was free from this disease after many years of hard work. Some diseases have been removed from the portfolio, for example influenza in swine and Schmallenberg. But all in all the value of the assets generated has significantly overreached the reductions.

Such an investment portfolio has a big value economically. It reduces the costs in animal production, less disease reduces the use of antibiotics, it reduces the risk for zoonosis and it is good for animal welfare and creates opportunities for export of animal products, like genetics. It also strengthens the Norwegian brand as a country signified bye a sustainable production and life style.

Where values are created there are also expenditures. The costs are connected to preventive measures, monitoring and control programs and fighting diseases, when they occur. The responsibility for covering these costs has to be carried out in good cooperation between government and industry. Controlling many of the diseases is strictly regulated and a responsibility of the authorities. Other diseases are not regulated in such a way that the authorities are fully in charge. Through strategic alliances and joint ventures the government and the industry have to sit down and agree on how specific challenges shall be handled.

With a portfolio like the one for animal health it is easy to make the mistake to focus only on the costs and forget the value. We easily take the value for granted. First when we loose it we understand the grave consequences. Then it can be too late.

An important framework for fighting animal diseases in Norway, as well as in the EU, will be the new animal health law. The new law will not be a big change from today's regulation. But the work with the disease list and the categorization of diseases on the list is important. It will be the basis for consideration of necessary national measures, that has to be carried out to secure to days good animal health status.

## Animal welfare regulations – same, same but different?

Frida Lundmark and Charlotte Berg

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Animal welfare regulations often have a purpose of preventing and identifying risks of poor welfare, i.e. focusing on risk assessment. This is one of the reasons why regulations often contain more input (resource- and management-) based requirements than animal-based requirements. So how much can we actually use different regulations when it comes to animal welfare assessment and surveillance?

In a recent Swedish study the animal welfare legislation and a number of private standards for dairy cows were analysed for content, structure and actual control outcomes. The result from this study showed that even if the requirements were quite similar the control outcomes differed substantially. One reason for this was that compliance with similar requirements could be measured in different ways. A resource-based requirement could be controlled using both resource- or animal-based measures, and this could be done at an individual or at a herd level. There were also differences with respect to the focus of the various regulations. Arlagården´s most common type of non-compliance was dirty cowsheds, which mirrors their focus on food safety and hygiene. Dirty cowsheds was a rare non-compliance during the official control, which instead had dirty dairy cattle, i.e. an animal-based outcome, as the most common non-compliance. Furthermore, more problems concerning claw health was detected during the Arlagården controls than the official controls, which may be a result of the advisory company Växa Sweden carrying out the Arlagården controls. Växa has been working actively with problems around claw health and lameness in dairy cows.

There appears to be a general consensus within international farm animal welfare research that the most common and severe welfare problems for dairy cows are mastitis and lameness, rather than dirtiness. However, non-compliances related to mastitis and lameness were rarely recorded during controls. One reason for this can be that it is most often not considered a non-compliance to have a sick or injured animal, as long as itis under treatment. Another reason may be that mastitis and lameness is not mentioned per se in the regulations, in contrast to dirty animals. A regulation mainly consists of minimum levels, which means that compliance with a regulation does not necessary guarantee a good welfare or absence of welfare problems. Since the main purpose of a control is to checking for compliance and not measuring animal welfare per se this means that control statistics do not necessary mirror the actual animal welfare level in a region or country but reflecting the focus of the regulations. It could also be questioned if dirty animals don't deserve more attention by researchers and advisory organisations since it is the number one welfare problem according to control statistics.

Is the high prevalence of dirty cattle the result of this focus in the regulations, or are the generally large problems with mastitis and lameness a result of too little focus on these problems in the regulations? In any case, we can conclude that control statistics can to some extent be used to detect health and welfare problems, but in its present form will certainly not give the whole picture.

## Consumers preferences and the marketing of good animal welfare

Marianne Kulø, Head of science

The Norwegian Animal Protection Alliance (Dyrevernalliansen)

The Norwegian Animal Protection Alliance helps those animals who need it the most, in intensive farming, the fur industry and in animal experimentation. We collaborate with a wide range of stakeholders in in order to make better farming – breeding, management and production systems – economically sustainable.

Animal welfare labelling is potentially an important method of improving welfare in Norwegian livestock production. The agricultural sector in Norway is relatively homogenous, dominated by a cooperative culture where animal welfare labelling traditionally has been viewed as ethically problematic. Therefore, there have been no attempts at such labelling until now. Norwegians are not used to market differentiation on animal welfare, and have a relatively high level of trust in animal welfare problems being solved by the government and the cooperatives. They have not been taught to include animal welfare as an issue to consider when buying food. However, Norwegians have started to become more concerned with farm animal welfare issues and are now more interested in information about how the food is produced. There seems to be a growing demand for animal welfare labelling. In recent years, animal welfare labelling has also become an increasingly hot topic in the food industry and among retailers.

## Koorimp – Husdyrnæringens koordineringsenhet for smittebeskyttelse ved import, «The very beginning»

Trygve Grøndalen

Presentasjonen består av Power point-sider, som kommenteres, med fokus på tiltak og «hendelser» med stor betydning for opprettelsen av Koorimp i 1995, -og litt importstatistikk.

Her tas det med noen vurderinger av de litt turbulente åra før og etter EU-kampen i 1994. Det ble Nei til EU, men vi var allerede bundet til EØS-avtalen.

«Konkurransestrategiene for norsk mat» var forarbeidet til «Kvalitetssystem i landbruket», lansert i 1995. Dette arbeidet var ressurskrevende og skapte mange friske diskusjoner, og forhåpentligvis ble det en generell kompetanseheving og holdningsendring i næringa. Kvalitetssikring, prosedyrer og dokumentasjon av status i produksjonen var vanskelig å forholde seg til for mange. Nye begrep, flere protokoller og mer skrivearbeid. Noen mente nok fortsatt at vi var «best» eller i alle fall «bra nok», slik vi var.

Kunnskapen om EØS-avtalen, vedtatt i 1992, gjeldende fra juli 1994, var ikke stor. Avtalen var bedre enn sitt rykte i Norge, spesielt kombinert med SPS-avtalen i WTO. Den ga land med dokumentert frihet for definerte smittestoff rett til å stille tilleggskrav ved import.

De kompenserende tiltaka fra veterinærmyndighetene med overvåkingsprogram i Norge, basert på SPS-avtalen, ble gledelig omfattende. Faglige støttefunksjoner for Koorimp var helsetjenestene, avlsorganisasjonene, Norges veterinærhøgskole, «søsterenhetene» i Norden og ikke minst Veterinærinstituttet og egne Fagråd.

Koorimp var ikke generelt mot import. Dette og sterk satsing på faktabasert informasjon og stor tilgjengelighet var trolig en vesentlig årsak til at vi raskt syntes å bli betraktet som et nyttig rådgivningskontor. Styringsgruppa besto i starten av 12 organisasjoner, nå 15.

En viktig, men for noen en skuffende, informasjon var at det ble innført toll i 1994. Dette dempet importlysten. Fram til 1997 kom det for øvrig storfe tollfritt til Norge fra de nordiske landa. Dette var etterslep av statlige tillatelser fra tiden før EØS-avtalen. Med to av disse importene kom det inn Paratuberkulose. I Europa herjet Kugalskapen. Disse tre elementene dempet utvilsomt lysten til å importere dyr til Norge og lettet arbeidet i Koorimp.

Skal store fellestiltak lykkes må det skapes noen felles grunnholdninger i tillegg til å holde fokus på et felles mål. Koorimp sentralt satset informasjon i mange kanaler, lett tilgjengelighet for alle interesserte og noe oppsøkende virksomhet. De faglige støttene drev også med holdningsskapende arbeid, og medlemmene i Styringsgruppa var gode trendsettere i sine miljø. I tillegg til felles mål og entusiasme må det også finnes et rettferdig regelverk og en fornuftig skjeling til ansvar, myndighet, roller og hatter.

En artikkel om Koorimp og andre tiltak i norsk husdyrbruk i 1980-90 finnes i Norsk veterinærtidsskrift nr. 3 / 2016, s 186-193.

## Det nordiska samarbetet

Hannele Nauholz

Djurens hälsa ETT rf Finland

En viktig förutsättning för en lönsam nordisk husdjursproduktion är en bra hälsostatus av produktionsdjur. I alla nordiska länder har livsmedelsindustrin därför traditionellt tagit ansvar för förebyggande och bekämpning av smittosamma djursjukdomar i samarbete med veterinärmyndigheter.

I Danmark var det Landsudvalget før kvæg/svin – numera SEGES – som fungerade som ”banbrytare” och mönster för andra länder sedan 1970-talet. I mitten av 1990-talet grundades i Finland Föreningen för bekämpning av djursjukdomar ETT rf, numera Djurens hälsa ETT rf (1994), i Sverige Svenska Djurbönders Smittskyddskontroll SDS (1995) och i Norge KOORIMP (1996). Alla dessa organisationer har likadana uppgifter med smittskyddskontroll och koordination av näringens tilläggsinstruktioner för import av produktionsdjur – samt deras embryon och säd – eller andra djur, som kan bära sjukdomar, som kan vara smittosamma för produktionsdjur (t.ex. kameldjur).

Målsättningen är att förhindra att djursjukdomar, som kan orsaka djurlidande, ekonomiska förluster eller som kan utgöra smittrisker för människor, ska föras in till de nordiska länderna. Tilläggsinstruktioner av näringen gäller sjukdomar eller tillstånd som inte fattas av de officiella importkraven. Med isolerings/karantäns- och undersökningsförfarandet kan sådana smittorisker uteslutas eller åtminstone minskas. Riskbaserad rådgivning ges till alla som planerar importen. Näringens tilläggskrav är juridiskt frivilliga att följa, men krävs t.ex. för att få leverera djur till slakt eller mjölk till mejeri eller för att få försäkringsskydd för sin djurproduktion.

Om att kunna kartlägga smittorisker och värdera deras svårighetsgrad för importbesättningen eller hela produktionskedjan samt om att planera förfaringssätt för behärskning av sådana risker är det nyttigt att ha kontakt till kollegor, som arbetar för likadana organisationer. Den nordiska samarbetsgruppen med KOORIMP, SDS, ETT och tidvis också SEGES har sedan 1995 träffat sig regelbundet och hållit möte om aktuella smittorisker vid import, liksom blåtunga, Schmallenberg-virus, Mycoplasma bovis eller PRRS, och om möjligheter att kontrollera risker. Gruppen har också planerat tillsammans beredskapsmöten, som har hållits för att befrämja samarbetet mellan näringen och myndigheter i Stockholm 2003, Oslo 2006 och Helsinki 2009.

Genom den nordiska samarbetsgruppen är det möjligt att ha nyttigt informationsutbyte på ett enkelt och oformellt sätt. Tröskeln är låg för att ringa eller skriva e-post till en kollega, som sysslar sig med samma ärenden. Det finns många gemensamma prioriteter (t.ex. BVD-frihet i alla länder), men också olika betoningar i smittbekämpning. Vi kan lära av varandra t.ex. av Sveriges sätt att bekämpa paratuberkulos eller av Norges effektivitet med MRSA. Finland gör sitt bästa med bekämpning av Mycoplasma bovis, och vi alla hoppas att Danmark lyckas bli av med Salmonella Dublin.

ETT gratulerar KOORIMP hjärtligt och önskar allt gott för de kommande åren!

## En risikovurdering av import av levende storfe til Norge fra Sverige, Danmark, Storbritannia, Nederland, Frankrike, Canada og New Zealand

Tormod Mørk, Helga Høgåsen og Ståle Sviland

Veterinærinstituttet

KOORIMP spurte i august 2016 Veterinærinstituttet å gjøre en risikovurdering av import av kjøttfe til Norge fra Sverige, Danmark, Storbritannia, Nederland, Frankrike, Canada og New Zealand. Bakgrunnen for forespørselen var underdekning av norskprodusert storfekjøtt som har skapt økt interesse for import av livdyr. Rapporten er basert på relativt lett tilgjengelige datakilder og er av generell natur. Ved konkrete importer anbefales det at man gjør spesifikke vurderinger basert på antall dyr og besetninger samt kunnskap om besetningsprevalens og prevalens innen besetningene.

I utgangspunktet ble OIEs- og Mattilsynets listeførte smittestoff for storfe valgt ut for vurderingen. I tillegg ønsket KOORIMP en vurdering av sine anbefalte tilleggskrav ved livdyrimport. Etter en innledende vurdering ble lite aktuelle agens ekskludert og til sammen 27 smittetrusler inkludert for risikovurderingen.

Risikovurderingen omfatter en vurdering av sannsynligheten for innførsel av hvert av disse fra hvert av landene, sannsynligheten for at de ikke vil oppdages i importisolat i Norge og overføres til den norske storfepopulasjonen, samt en konsekvensvurdering av dette for hver av smittetruslene.

Til slutt ble det gjort et risikoestimat (sammensatt sannsynlighet for introduksjon og konsekvenser av dette vurdert sammen) for 5 viktige smittetrusler; paratuberkulose, tuberkulose, Mycoplasma bovis, Q-feber og Chlamydophila abortus for alle sju landene.

**Resultater**

Import av kjøttfe fra Sverige ble generelt vurdert som tryggest og betydelig tryggere enn fra noen av de øvrige seks landene. Fra Sverige er det lav sannsynlighet for import av M. bovis og Q-feber, men konsekvensene kan bli store hvis de importeres. Ved etterlevelse av KOORIMPs tilleggskrav er risikoen for M. bovis redusert. Det samme gjelder for M. bovis og Q-feber under omtalen for de øvrige landene. Ved å unngå å kjøpe inn dyr fra Syd-Sverige reduseres risikoen for å importere Parafilaria bovicola, Salmonella Dublin og Hypoderma bovis

Fra Danmark er det høy risiko for import av paratuberkulose og M. bovis. Også for paratuberkulose kan konsekvensene bli store hvis den importeres. Det er lav sannsynlighet for import av Q-feber. Andre viktige smittetrusler fra Danmark er S. Dublin og MRSA.

Fra Frankrike er det høy risiko for import av paratuberkulose og M. bovis. Det er moderat sannsynlighet for import av C. abortus, og konsekvensene kan bli store hvis den importeres. Det er lav sannsynlighet for import av Q-feber. Med livdyrinnkjøp fra Frankrike risikerer man import av en rekke andre viktige smittetrusler.

Fra Nederland er det høy risiko for import av paratuberkulose og M. bovis. Det er lav sannsynlighet for import av Q-feber. Med livdyrinnkjøp fra Nederland risikerer man import av en rekke andre viktige smittetrusler.

Fra Storbritannia er det høy risiko for import av paratuberkulose og M. bovis. Det er moderat sannsynlighet for import av storfetuberkulose, og konsekvensene vurderes å være moderate. Det er lav sannsynlighet for import av Q-feber. Med livdyrinnkjøp fra Storbritannia risikerer man import av en rekke andre viktige smittetrusler.

Av Fra New Zealand er det høy risiko for import av paratuberkulose. Det er lav sannsynlighet for import av storfetuberkulose, og konsekvensene vurderes å være moderate. Med livdyrinnkjøp fra New Zealand risikerer man import av en rekke andre viktige smittetrusler.

Fra Canada er det høy risiko for import av paratuberkulose og moderat sannsynlighet for import av Mycoplasma bovis. Det er lav sannsynlighet for import av Chlamydophila abortus, men konsekvensene kan bli store hvis den importeres. Det er lav sannsynlighet for import av Q-feber. Ved livdyrinnkjøp fra Canada risikerer man import av en rekke andre viktige smittetrusler.

**Konklusjon**

Risikoen for paratuberkulose er stor ved import fra Danmark, Nederland, Frankrike, Canada eller New Zealand selv ved tesing i opprinnelsesbesetning og importisolat. Andre viktige smittetrusler er blant annet tuberkulose, M. bovis, Q-feber og C. abortus. Risikoen for at ett eller flere av disse vil innføres ved import fra alle unntatt Sverige vurderes som stor. Risikoen øker med antall dyr og besetninger. Med unntak av Sverige risikerer man i tillegg import av en rekke andre viktige smittetrusler.

Import av gener via embryo og/eller sæd er et langt bedre alternativ enn import av livdyr.

## New methods and data sources for efficient animal disease surveillance

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The view that animal health surveillance is important for prevention of disease has a long tradition within the Nordic countries. This is based on the logic that prevention is, in general, both better and less costly than cure for efficient management of animal health and welfare. Still, surveillance activities require resources, and the positive effects of prevention and absence of disease may be difficult to estimate and to justify. Cost-efficient allocation of resources to surveillance is a complex task, and a continuous development of new tools and methods to achieve this is needed. To enable comparison of surveillance strategies, methods to evaluate and measure the performance of surveillance is a crucial part of this work.

In this presentation, examples from recent and ongoing studies of surveillance for diseases such as salmonella, VTEC, and African swine fever, will be given. The research includes disease freedom evaluations, disease spread modelling, and data-driven surveillance. How this type of research results can be used in the systematic planning and evaluation of national surveillance programs will also be discussed. The main conclusion is that modern animal disease surveillance is not a purely number-crunching challenge, but a combination of sophisticated data-driven modelling, and very traditional work of continuous communication and collaboration.

## Ongoing animal health and welfare projects – Nordic and arctic veterinary authority collaboration

Thora Jónasdottir

The Nordic Council of Ministers (https://www.norden.org/en/nordic-council-of-ministers/ - Nordiske Ministerrådet) is the official inter-governmental body for co-operation in the Nordic Region. Within the path of the Nordic Council, the Nordic Working Group for Microbiology & Animal Health and Welfare (NMDD) is found. The objective of the working group is to ensure that the Nordic authorities work together effectively within this field. To reach the goal, the group exchange information about the situation in each of the Nordic countries and support initiatives of collaboration on projects and activities in accordance with the Nordic Council priorities. There are now 10 years since the NMDD working group was established and many projects have been supported. Among these, the two ongoing projects will be presented below.

A. Evaluation of practical animal based welfare indicators in routine governmental inspections at farms. The goal of the project is to suggest and test a Nordic coordinated scoring system of the most informative and practical animal based welfare indicators. To limit the scope of the project, scoring system will initially only be developed and tested for cattle. The indicators chosen are based on the five criteria of animal welfare; freedom from hunger and thirst, freedom from discomfort freedom from pain, injury or disease, freedom from fear and distress, and freedom to express normal behaviour. The indicators chosen to reflect the freedoms are: 1) Body condition score 2) cleanliness 3) lameness 4) injuries 5) aggression or anxiety. The group has developed a simple scoring system that enable the inspectors consistently to evaluate, qualitatively and quantitively, the overall situation at the farm, and to decide whether the animal welfare in the flock is within the legal framework or not, or if special follow up is needed. By using a coordinated scoring system, the development of the situation can more easily be supervised within the Nordic countries.

B. The arctic veterinary collaboration. In the arctic Nordic countries, Greenland, Iceland, Faroe Islands and Norway (North-Norway) the veterinary authorities have many special challenges in common, both within animal health and animal welfare issues. Collaboration will give better opportunities to maximize the utility of governmental veterinary resources. The arctic countries can support each other in developing national veterinary contingency plans (animal disease prevention) for emerging diseases. Further, it can be important to get an overview of diagnostic capacity in each country. Animal welfare matters that are considered to be of common interest for the arctic countries are for example the handling, killing and other welfare issues of sea mammals within the scope of both commercial hunting and incidental happenings for individual animals. Important issues for networking and discussion between the arctic countries are among others what methods of hunting sea mammals are acceptable, how the legal framework can best ensure good animal welfare in different situations and how the implementation of the legal framework is most efficiently supervised. Further the arctic countries could benefit from establishing a common team of expertise of how to handle large sea mammals in case of accidental emergencies.

## Passive surveillance of VHSV genotype Id in brackish water rainbow trout farms was superior to active surveillance.

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The fish farming industry in the Province of Åland, in the Baltic Sea struggled with unsuccessful eradication attempts of viral haemorrhagic septicaemia (VHS) in Finnish brackish water rainbow trout farms in the 2000s. The official surveillance programme was often unable to find VHSV-positive populations and led to the misbelief among fish farmers that eradication of the virus could be achieved.

The official EU programme was compared to three other surveillance programmes to detect infected farms. One programme involved passive surveillance, while two consisted of active surveillance similar to the official programme, with the exception that they included increased sampling frequencies and two additional tests. The passive surveillance concentrated on sending in samples when any sign of a possible infectious disease at water temperatures below 15°C was noticed. Passive surveillance clearly outperformed active surveillance in this study.

## Optimising targeted surveillance for bovine virus diarrhoea

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In 1986, 28% of the Norwegian cattle herds had antibodies for bovine virus diarrhoea virus (BVDV) (Løken et al., 1991). BVDV caused substantial losses to the cattle industry and in 1992, an eradication programme was started as a collaboration between the authorities, the cattle industry and cattle farmers and the Norwegian Veterinary Institute (Løken and Nyberg, 2013). From 2007, no new cases have been detected. Calculations on data from the BVDV surveillance programme in 2011 showed that the probability of freedom from BVDV in the cattle population was 0.996 at the end of 2011, at a design prevalence of 0.2% (Norström et al., 2014). In the surveillance programme for BVDV in Norway approximately 1200 dairy herds (bulk milk samples) and 1200 beef suckler herds (blood samples at the abattoir) are randomly selected and tested for BVDV antibodies every year.

The aim of the study was to compare different risk-based approaches of sampling with random sampling to optimise the surveillance programme for BVDV in dairy cattle in regard to surveillance sensitivity. By using risk-based sampling, it may be possible to either decrease the sample size or increase the efficiency of the surveillance compared to random sampling from all herds. The probability for each herd of having or contracting the infection is taken into accou2%, was calculated from year 2012 data in a scenario tree (Martin et al., 2007). The estimates were obtained in a simulation model programmed in R with 5000 iterations. The different risk-based approaches modelled were based on samples selected from herds assigned to different numbers or combinations of the risk-indicators, e.g. samples from herds having ≥2 risk-in nt by assigning each herd different risk-indicators. The risk-indicators were obtained from the Norwegian Dairy Herd Recording System and were: large herd size, purchase of animals, reproduction performance (return-to-service within 56 days), abortion and calf mortality.

The surveillance sensitivity, i.e. the probability to find an infected dairy herd if the herd design prevalence is 0. dicator, ≥3 risk-indicators, ≥1 reproduction risk-indicator. The estimated surveillance sensitivities from these approaches were calculated for different sample sizes and were compared to the estimates when taking samples from any herd.

Our results showed that when sampling 5-15% of the total population all our risk-based approaches had a substantially higher sensitivity compared to taking samples from any herds. When sampling larger proportions of the population, as 20%, the differences in surveillance sensitivity were not significant. The results show that it is possible to reduce the sample size to some extent in the BVDV-programme if risk-based sampling is introduced. However, a smaller proportion of the population would be sampled from and the coverage might be reduced. In addition, the sensitivity is not the only parameter for measuring the efficiency of a surveillance programme. Amongst others, timeliness and cost efficiency may be included to get a more complete picture of the efficiency.

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## Big data – modelling of midges in Europe using machine learning techniques and satellite imagery

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Biting midges (Diptera, Ceratopogonidae) of the genus Culicoides are important vectors of pathogens causing diseases in free living and production animals and can lead to large economic losses in many European countries. In Europe, Culicoides imicola and the Obsoletus group are considered to be the main vectors of bluetongue virus that mostly affects ruminants such as cattle and sheep. Spatio-temporal modelling of vector distribution and abundance allows us to identify high risk areas for virus transmission and can aid in applying effective surveillance and control measures.

We used presence-absence and monthly abundance data of Culicoides from 1005 sites across 9 countries (Spain, France, Denmark, Poland, Switzerland, Austria, Poland, Sweden, Norway) collected between the years 2007 and 2013. The dataset included information on the vector species abundance (number of specimens caught per night), GPS coordinates of each trap, start and end dates of trapping. We used 120 environmental predictor variables together with Random Forest machine learning algorithms to predict the overall species distribution (probability of occurrence) and monthly abundance in Europe. We generated maps for every month of the year, to visualize the abundance of C. imicola and Obsoletus group in Europe as well as distribution maps showing the probability of occurrence.

We were able to create predictive maps of both Culicoides sp. occurrence and abundance using Random Forest models, and although the variance was large, the predicted abundance values for each site had a positive correlation with the observed abundance. We found relatively large spatial variations in probability

of occurrence and abundance for both C. imicola and the Obsoletus group. For C. imicola probability of occurrence and abundance was higher in southern Spain, where as the Obsoletus group had higher probability of occurrence and abundance in central and northern Europe such as France and Germany. Temporal variation was also observed with higher abundance occurring during summer months and low or no abundance during winter months for both C. imicula and the Obsoletus group, although abundance was generally higher for a longer period of time for C. imicula than for the Obsoletus group.

Using machine learning techniques, we were able to model the spatial distribution in Europe for C. imicola and the Obsoletus group in terms of abundance and suitability (probability of occurrence). Our maps corresponded well with the previously reported distribution for C. imicola and the Obsoletus group. The observed seasonal variation was also consistent with reported population dynamics for Culicoides, as it depends on environmental factors such as temperature and rainfall. Longer seasonal abundance for C. imicula compared to the Obsoletus group can be explained by the species distribution, as C. imicula is limited to the southern parts of Europe where the warm season lasts longer, whereas the Obsoletus group is found further north. The outputs obtained here will be used as input for epidemiological models and can be helpful for determining high risk areas for disease transmission.

## Assessment of animal welfare in broiler flocks

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Animal welfare is about the individual animal's physical and mental wellbeing. Some definitions of animal welfare emphasize the biological function of the animal, which includes animal health, production and growth. Other definitions emphasize animal negative and positive subjective experiences- such as pain, frustration, positive anticipation and pleasure. Today there is broad consensus that animal welfare is about the animals' physical and mental health – animals should “be fit and feel good” - and that therefore an overall assessment of animal welfare should be based on information about biological function AND subjective experience of the animals. Thus, behavioural, physiological, health and production-related indicators reflecting the individuals' emotions and health are used as animal based indicators. Animal welfare is affected by several factors in the animals' physical and social environment, and factors that can be measured in the environment give important information about animal welfare. Management, e.g. access to feed, water, and farmers' practices affect the welfare and are therefore used as a resource-based indicators.

Although animal welfare is about how the individual perceives its situation, the focus of welfare assessment is often on flock level. A broad welfare assessment on flock level involves measuring various welfare indicators using a welfare protocol. A welfare protocol is a tool to measure the "total" welfare level of livestock as objectively as possible. The protocol consists of a collection of selected welfare indicators, and a description of how these indicators are measured. An example of a welfare protocol where both animal-based and resource-based indicators measured for the overall welfare assessment is the WelfareQuality® protocol for laying hens and broiler chickens. Health registrations and production data collected in monitoring programs/ at the slaughterhouse and through livestock data registrations also provides important information that can be used as a basis for welfare assessment. Examples of various welfare indicators that are relevant to the assessment of animal welfare in broiler flocks, including footpad lesions, lameness, and slaughterhouse data, are presented in the lecture. The Norwegian Animal Welfare Program for broiler chickens is briefly outlined, and the need for additional indicators for future welfare assessment in broiler flocks is discussed.

## Risk based surveillance of vector borne infections - the daily transmission potential of Schmallenberg in Denmark 2013 to 2016

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Denmark started a surveillance program for biting midges in 2013. The program monitors the weekly abundance of biting midges on three selected cattle farms. The vector abundance is weekly updated on www.myggetal.dk. The abundance of biting Obsoletus midges on the three cattle farms varies dramatically with peak periods observed in the months of May, July, and late September. Between these population peaks there can be weeks of very low abundance of biting midges. Additional to the 'within year variation' there is also a very large 'year to year variation' in the population pattern. It is not clear what determines the population dynamics of the biting midges. Until a population model for vector abundance is developed the present active vector surveillance is the only way to obtain reliable dynamic abundance data.

Vector abundance is a key driver of the transmission potential of a vector borne disease. Because of the cold Scandinavian climate the transmission season is short and good estimates of the seasonal transmission potential can therefore be used to optimize the timing of disease surveillance in livestock. Precisely defining the start and the end of the transmission season for a specific vector borne infection in a specific year may allow us to target national serological surveillance soon after the potential transmission season has ceased. Optimizing the timing of serological surveys on farms allows rapid free testing for export purposes and can also dramatically reduce the number of the costly serological samples needed – known as 'targeted surveillance'. Precisely defining the start and the end of the transmission season may furthermore guide veterinarians to choose the best diagnostic tests when presented with clinically sick animals. Therefore, knowing if the period where a sick animal is presented is a potential high risk period can increase the probability of early detection of exotic diseases in a country.

Considerable effort has been put in surveillance of biting midges in Europe and this is to predict risk of Culicoides borne infections like Bluetongue and Schmallenberg virus in ruminants. But we found a relatively poor correlation between vector abundance on a specific day and the risk of disease transmission for that day. Additionally we found a very poor correlation between vector abundance on a specific day and potential clinical illness for that day. This suggests that vector abundance alone is a relatively poor criterion for diagnostic decision making. We developed a mathematical process model for estimating the daily transmission potential. Based on the daily vector abundance and the temperature the model predicts the relative potential for clinical illness on a given day based on the cumulative transmission potential in the preceding month while assuming a uniform risk of introduction. The model also predicts the potential future transmission risk (the R0) following an introduction of an infectious host on that given day.

Despite high abundance of Obsoletus midges in May the temperatures were too low to allow for transmission of Schmallenberg virus. But during the summer period the vector abundance was a good predictor of the R0 following an introduction of an infective host. However the daily vector abundance was often very low when the transmission and disease risk were at the highest. This was because the peak of transmission from vectors to new hosts was often delayed by two or more weeks after the peak of transmission from hosts to vectors. Therefore, clinical disease occurred well after the vector populations peaked, making the daily vector abundance a poor predictor of disease incidence risk; unless the vector abundance was first processed in a mathematical model which is able to handle these delays.

## MRSA research in Denmark – a close collaboration between the veterinary and human side

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LA-MRSA was first found in Danish pigs in the EU baseline survey in 2008, 3.5% of the herds were positive. This figure has increased to dramatic 68 % in 2014 and now likely even higher. This development has prompted considerable political and media attention and a requirement for more knowledge about both the biology and dynamics of this bacterium and possibilities to intervene in order to eradicate or reduce its presence.

In Denmark, a national research effort was initiated in 2015 in order to provide the necessary knowledge and risk assessment about LA-MRSA for authorities to make decisions about how to move forward in the Danish pig industry on risk management.

LA-MRSA is mainly a working environmental hazard, and the primary goal is therefore to reduce the exposure of people who work at contaminated pig farms and their household members. However, an increase in number of infections among humans without livestock contact has been increasing, so the ultimate goal is to identify infection route also to community acquired infections and find was to prevent them.

The research initiative is carried out as a close collaboration between DTU National Veterinary Institute and Statens Serum Institute and integrates human and veterinary aspects in a true one-health perspective. The project includes (i) studies on within and between herd dispersal of LA-MRSA (ii) quantification of LA-MRSA on animals and in environment, and quantitative evaluation of intervention strategies – including economic consequences for the industry and society, (iii) identification of risk factors and clinical consequences for human disease caused by LA-MRSA, and (iv) population dynamics of LA-MRSA infection in farmers and household members.

Preliminary results and conclusions will be presented.

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