

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA17110 - Standardizing output-based surveillance to control non-regulated diseases of cattle in the EU

STSM title: Using cattle movement data in the control of infectious diseases in Norway

STSM start and end date: 18/11/2019 to 28/11/2019

Grantee name:

PURPOSE OF THE STSM

A two-fold aim was formulated for the STSM:

- To characterize cattle movements in Norway using social network analysis.
- To explore the potential use of cattle movement data in the control of infectious diseases with digital dermatitis as a case example.

The work was expected to lead to better integration of animal movement data in control of infectious diseases in Norway.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMs

Before the STSM substantial efforts were made to obtain data on cattle movements from the Norwegian livestock registry which is owned and administered by the Food Safety Authorities. However, it proved difficult to get the requested data in time. Instead data was retrieved from the Norwegian Dairy Herd Recording System (NDHRS), where 98% of all dairy herds are members. However, beef herds are not included.

The first days of the STSM were used for exploring and cleaning data. In the NDHRS, all outgoing movements are recorded as events; such as the animal being slaughtered, euthanized or sold. In case the animal was sold the record needs to be paired with an ingoing event in another herd. After cleaning, descriptive statistics on movements as well as simple network measures were calculated.

We chose to limit the study to the period from Jan 1st 2010 to Nov 9th 2019. Only complete purchases were retained. To assess temporal patterns, histograms of movements were made for all years. To get an overview of geographical trends, a matrix of counts of movements between Norwegian counties was made. Work on social network analysis was started during the STSM, calculating and visualizing simple network measures. Additionally, a weighted network was made to assess the number of animals per movement.

Data cleaning was performed in Stata, and descriptive statistics and network analysis was performed in R-studio, using the EpiContactTrace package.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The original dataset had 3 642 026 observations, of which 731 405 were records of animals sold out to life (i.e. purchased as livestock by another farm), with an associated date of event. However, 326 676 of these events lacked a corresponding record for entry to a new herd, indicating a problem with using the NDHRS for an overall description of cattle movements in Norway.

The cleaned dataset contained movements between 8 972 source herds and 10 507 destination herds. The total number of herds were 10 507, meaning many herds were included both as the source and as destination herd during the study period. The number of unique combinations of source and destination herds were 66 267, and the number of animals per contact ranged from 1-396 with a median of 2 animals per purchase.

There were both geographic and temporal trends in cattle movements. There was a recurring peak in cattle movements in July, and the lowest number of movements during the winter months. The largest proportion of both source herds and destination herds were located in Rogaland and Trøndelag county, south-west and mid Norway, respectively. Trøndelag was the source county in 82 258 movements (20%), and the destination county in 88 083 (22%) movements. Most movements (n=79 806) to herds in Trøndelag were short distance, i.e. from source herds within the same county. Rogaland was the source county in 77 122 movements (19%), and the destination county in 88 083 movements (22%). Similar to Trøndelag, the majority of movements (n=72 373) had both source and destination herd within the county also for Rogaland.

The distribution of in-degree was heavily skewed to the right as the majority of herds had few ingoing movements. A network summary was made for the three last years; in 2016 the in-degree ranged from 0 to 34, with a median of 0, and a mean of 0.93. 6410 herds (56%) had zero movements in 2016. The numbers were similar for 2017 and 2018 in which 58% and 61% of herds had zero movements, respectively.

FUTURE COLLABORATIONS

The collaboration with the National Veterinary Institute (Sweden) will be continued in the ongoing work of utilizing animal movement data for research and surveillance purposes in Norway.


The work performed during the STSM revealed that using the Norwegian Dairy Herd Recording System as a source of cattle movements data is challenging due to a large proportion of incomplete records. Using data from the Norwegian livestock registry is therefore preferable as all movements are included regardless of production type. A meeting is scheduled with the Food Safety Authorities in January 2020 to plan for exchange of data for this and future projects. When movement records from this database are obtained, the work from the STSM will be continued, and the data on cattle movements will also be linked to herd level registrations on digital dermatitis obtained in another ongoing project at the NMBU in collaboration with the National Veterinary Institute in Sweden.

Approved by host institution.

Date and place: 2019-12-17, Uppsala


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Date and place: 2019-12-18, Oslo


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