

Health and welfare surveillance in farm animals – using existing register data from public and private partners

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Abstract

To assess the health and welfare status of farm animals one approach is to measure it using already existing register data. This is of interest as many routine data are available in Germany, generated at farms, slaughterhouses or by different monitoring programmes. To overcome the segregated use of these data and to improve our knowledge on animal health, a public-private partnership tool for integrating and exchanging existing data on finishing pigs collected along the food production chain will be established.

This idea and its realisation implicate new challenges concerning the use of existing data for health description on farm level, the integration of disparate data from different data owners as well as legal matters. Particular focus is given on the selection of suitable indicators assessing health in finishing pigs and the composition of health score.

To our knowledge this project is one of the first attempts in veterinary science in Germany, which makes use of an overarching data access for animal health.

Keywords: *animal health indicators, public-private partnership, secondary data use.*

Introduction

In the past years, there is an increasing interest to improve and document health and welfare of farm animals. To be able to describe the animal welfare status on farm level is a public concern (1,2). This led to the development of different welfare assessments strategies, including strategies to provide animal based indicators assessed directly during farm visits, but also current research efforts which are trying to make use of already existing register data.

Whereas the collection of data during farm visits is time consuming and costly, a secondary use of already existing register data might have the potential to:

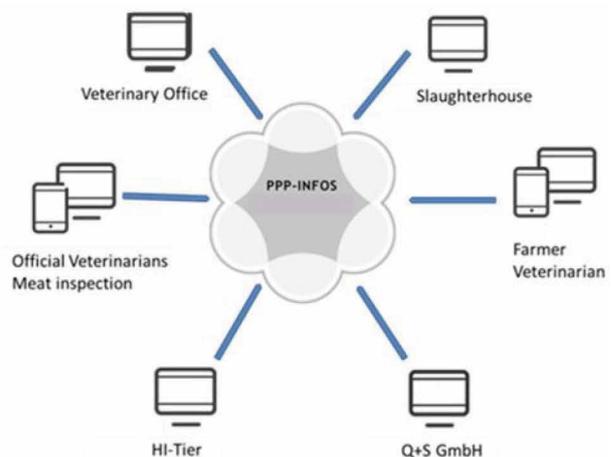
- identify herds with health problems and specify areas for improvement,
- allow to compare or benchmark farms in regard to different health aspects,
- enable a better understanding through the integration of disparate data.

The existing databases in Germany, both industry and government owned, contain animal health and welfare related data, which might be used describing the health status of farm animals.

This gave rise to our current project PPP-InfoS with its goal to develop a public-private partnership tool for improving the welfare and health in pig herds, by

- using the available register data and develop valid health indices for pig herds, and by
- integrating data from different data collections (public and private) to provide a broader view and better understanding of the health status on farm level (Figure 1).

Figure 1. Integration of existing data in a public-private partnership information systems PPP-InfoS.



Detailed study questions are:

- What data are available and suitable for our purpose (regarding content, legal and technical aspects)?
- How can we integrate or relate data to each other to identify farms with potential health problems and enable targeted advice?
- What are the best discriminative scores or indices if we want to combine disparate indicators into a single composite measure for a complex and multidimensional domain such as health?

- How do we construct and implement a public-private partnership information system which meets all requirements to ensure data safety and data protection?
- How do we ensure and evaluate the usefulness for different stakeholder: farmers, veterinary authorities, private partners and researchers respectively?

Materials and methods

To provide an overview over existing register data, we interviewed stakeholders from each group involved in food production (farmers, slaughterhouse operators, veterinary officers, producer organisations, veterinarians) and used a questionnaire to document information about the collected data. After that, a first selection of available health indicators took place.

For a further selection of suitable variables as health indicators, we analysed datasets from the year 2015 of post mortem meat inspection, serological salmonella testing and recordings on the use of antibiotic drugs from approximately 2,000 farmers. This included descriptions of data distributions, statistics on association and correlation, variance components and factor analyses.

The selected variables are being combined in several health scores, describing several areas (for example respiratory health, external injuries, etc.), and are being merged in an overall score. For each score we construct different versions, using different transformations of the entrance variable, different weights or different scoring methods. At the end, it will be evaluated, which score version is the most accurate to describe the actual health status in pigs.

In addition, we identified and described use cases for each stakeholder involved in pig production. Every stakeholder has different objectives when using health data and participating in this partnership information system. In order to establish an operating system, these objectives have to be met to ensure a benefit for all participators. Whereas farmers would benefit from a detailed overview of the health status of their produced animals and a benchmark function, veterinary officers might need more aggregated measures, which allow to rank farmers according to their health status. Therefore, twelve different use cases are described in this project.

As this project is realised in collaboration with a company specialised in information processing in this area, a demonstrator software will be created, based on the described use cases.

Finally, there will be an assessment of the added information value of the developed data information system as tool for continuous improvement in pig husbandry.

Results

Identification and selection of databases and variables

Initially starting with 32 indicators from a variety of different data collections, we reduced this to a list of 16 indicators that seem most useful to describe the health status of pigs (Table 1). The other indicators were excluded, either because there are no data available, no data available in a usable form (handwritten notes, stored in too many individual systems) or because data are not relevant for our questions, for example as they contain too little information.

The remaining indicators originate from post mortem meat inspection, mortality data collected by the farmers, data from antibiotic monitoring systems and a serological salmonella monitoring system.

Table 1. Indicators included in the PPP-InfoS system

Skin aberrations
Tail lesions
Ear lesions
Whole carcass condemnation
Pneumonia
Pleurisy
Liver (Milk spots)
Pericarditis
Arthritis
Abscesses
Bowel aberrations
Bursitis
Mortality
Antibiotic usage
Salmonella status
Violations against animal welfare

Development of health scores

The goal is to create scores which combine data from multiple indicators into a single variable and allow to compare the health status in pig groups. For this, we first examined existing correlations or associations between the data. With these results and expert advice, we determined different, mostly independent areas that are described by different scores. These include:

- Aberrations in the thoracic cavity
- External injuries
- Milk spots in the liver
- Antibiotic usage
- Salmonella status

For example for the score ‘aberrations in the thorax cavity’, records on pneumonia, pleurisy and pericarditis are included. Calculating discriminative scores, i.e. scores used to distinguish between groups (3), we use several approaches with different entrance variables. Indicator values can be entered as original or weighted prevalence or transformed into categorical values, as it is done in other studies (4,5). Another

approach is to use standardised z-scores or percentiles for each abattoir, to facilitate a uniform interpretation. This approach could help to address the problem that different conditions have different prevalence values and are diagnosed with varying frequencies in different abattoirs. All calculated score versions will be compared and evaluated.

Furthermore, after selecting the most accurate score, we will combine information from different areas, for example the use of antibiotics with occurring respiratory infections, to generate better knowledge for describing and improving the health status at a particular farm.

Discussion

The aim of the present study is to investigate the usefulness of existing register data for health measurement and to develop a demonstrator showing how to integrate public and private data from different information sources in one productive system.

Particular focus is given on the construction and evaluation of valid health scores. As this is currently an important issue, it would be useful to generate an overview of existing methods and frameworks especially in animal health and even more specific, using secondary data. This presentation will give insight in our approaches and experiences merging, for the first time, a vast amount of data from slaughterhouse records, antibiotic usage and other health information.

Moreover, while developing a public-private information system, it has been necessary to take a closer look at data owner and data stewardship, as there is some uncertainty about releasing data for a potential further use. This led to a description of a variety of use cases for different stakeholders

and will result in a complex authorisation matrix, defining the access rights for each user group. To obtain a working system, we have to ensure both, benefits for each stakeholder to encourage participation, and the prospect of improving animal health through a better understanding with consolidated information.

To our knowledge this project is one of the first attempts in veterinary science in Germany, which makes use of an overarching data access for animal health. Specific projects like PPP-InfoS help to demonstrate constraints and the need for further action to clarify legal aspects as well as systematic considerations on how to establish valid health indices.

References

1. **Brandt P.** *Assessment of welfare of finishing pigs from farm to slaughter.* PhD Thesis - Science and Technology: Aarhus University, 2015
2. **European Technology Assessment Group (ETAG).** *Animal-based Welfare Monitoring Final Report.* 2009
3. **Kirshner B, Guyatt G.** A methodological framework for assessing health indices. *J Chron Dis* 38, 27-36, 1985
4. **Sandgren CH, Lindberg A, Keeling LJ.** Using a national dairy database to identify herds with poor welfare. *Anim. Welf.* 18, 523-532, 2009
5. **Otten OD et al.** Comparison of animal welfare indices in dairy herds based on different sources of data. *Anim. Welf.* 25, 207-215, 2016

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