Discussions and Conclusion

The preliminary results observed in the participating German pig herds show a wide frequency variation of the eight HHWI parameters, which proves their usability for assessing herd health status and animal welfare quality as a precondition to identify assumed associations between herd health/animal welfare and the frequency of the occurrence of ESBL-producing E. coli.

The analysis of the impact of the herd health status and welfare quality on antimicrobial resistance will be the next step of the EFFORT project.

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FSA data for surveillance purposes are obvious; wider coverage, using an existing data collection system, which collects data about many conditions that could be used to help identify potential emerging animal health threats. However, some of the weaknesses identified for the use of this system in surveillance are: the accuracy of official routine meat inspection (which was considered imperfect for animal health conditions), the unknown level of standardisation and the poor data quality (e.g. there may be a multiple occurrence of a single condition to a single animal, difficulty of identifying holding place for the animals) (Watson et al., 2011).

The aims of this study were to a) compare the prevalence patterns (temporal and seasonal) in the different data sources for two selected outcomes (respiratory conditions and tail bite) and b) examine in more detail the agreement between BPHS and FSA data at batch level. Our results have shown that the temporal trends for respiratory disease were similar between the systems but seasonal trends and prevalence differed. For tail bite lesions, the temporal trend and seasonal patterns were completely different. At batch level the correlation of respiratory disease was low between the datasets as was the identification of positive batches for conditions such as tail bite.

Material and Methods

Data sources:
In the period of study, traditional inspection was carried out as detailed under the legislation (Regulation (EC) 854/2004). The inspection outcomes are recorded as a statutory requirement and these records constitute the FSA post/ante-mortem CCIR data source (referred to here as the ‘FSA data’). For each batch of pigs slaughtered, information is recorded at the abattoir by MHI, either via a “touch screen”, or a paper system, depending on the system implemented in each abattoir. The information recorded includes: the type and number of conditions observed (present/absent), the number of pigs in the batch and the type of pigs. This information is then transferred to the plant records and is printable for each batch (identified by the individual slap mark). Data are collected from FSA records and transferred (double entry) by plant personnel to a Microsoft Office Excel Worksheet. BPHS data is used to monitor the incidence of endemic syndromic conditions. Each farm enrolled into the scheme has quarterly assessments where data are recorded at the slaughterhouse from inspections of 50 slaughtered pigs per batch (selecting alternate pigs for assessment). The detailed operation of BPHS has been described previously (Sanchez-Vazquez et al., 2011).

Time period of the study (national level and batch trials):
Data sets for a 48 month period from June 2008 to May 2012 were acquired. However, the FSA dataset only started at August 2009 as the new electronic format of data were only collected from then on. Respiratory cases were defined for the national analysis as all the lesions recorded that affect lungs (e.g. pneumonia, pleurisy). Three abattoirs took part in the field trials during 2013 for batch comparison. Four trials were carried out. Data were recorded at animal level by the BPHS assessors and at batch level by the MHI, in accordance with their normal practices. For the batch analysis pneumonia was analysed separately from pleurisy.

Statistical analysis:
Generalised linear mixed models (GLMM) were used to detect significant differences in temporal trends in each dataset. Farm of origin of the pigs was the random effect (national analysis). Agreement between the two datasets, in the four trials, was evaluated using the correlation coefficient (pneumonia and pleurisy) and the Kappa value (tail bite: batches were categorised as positive or negative, due to the low prevalence). Significance was assessed using McNemar and paired t-test (batch analysis). All analyses were performed with R version 2.12.1 from R Foundation for Statistical Computing. http://www.r-project.org.

Results

National analysis:
There were approximate 900,000 BPHS pigs (from 2,543 premises) and 19 million pigs (31,578 premises) in FSA during the study period.

Respiratory conditions
The BPHS data suggested a possible increasing yearly trend with the prevalence of cases rising from 32.2% in 2009 to 40.0% in 2012. The FSA data also suggested an increasing yearly trend (14.8% in 2009 to 16.8% in 2012). In the GLMM, the BPHS model showed significant increased odds ratio (OR) of a pig having respiratory conditions over time (Figure 1a) and that the months July and March had the lowest OR (Figure 1b). The FSA model showed that the odds increased over time and that 2010 and 2012 were significantly higher than 2009 (Figure 1a). The results for month showed that there were two peaks, with high OR in the spring months and in November/December (Figure 1b).

Tail biting
The analysis of the BPHS data suggests a generally decreasing trend of tail biting prevalence from 0.44% in 2008 to 0.35% in 2012. The FSA data analysis produced contrary results suggesting a generally increasing trend from 2009 to 2012 (0.14% to 0.18%). In the multivariable models (Figure 2a and 2b), results from the BPHS data indicate that OR declined over the years. The odds of tail biting were about 11% higher in July and about 32% lower in December compared to January. Temporal patterns differ for FSA. OR increased over the
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time and OR were higher in May than January by 21% and lower in September and August by about 34% compared to January.

Figure 2: Tail biting odds ratio (OR) for year trend (2a – left plot) and seasonal trend (2b – right plot, x-axes range from 1 (January) to 12 (December)) for the two data sets.

Batch analysis:

FSA and BPHS data were obtained, at batch level, from a total of 53,479 and 18,748 pigs respectively from 332 batches during the trials. The overall results of the batch comparison show a statistical significant low correlation between schemes for pleurisy (0.47) and a moderate correlation for pneumonia (0.65). The agreement between schemes was low for tail bite (Kappa <0.04).

Discussion

Similar trends (for respiratory disease) were observed between data sets. The major difference between data sources at national level was the prevalence values, which were higher for BPHS in comparison to FSA. The same finding was observed in another study that compared routine meat inspection findings with systematic health monitoring in pigs in Denmark (Nielsen et al, 2015). This seems to suggest that there are differences in recording sensitivities between BPHS and FSA system (i.e. BPHS assessors detect more cases of respiratory lesions than FSA MHI). This has implications for the use of these data. In addition, the batch analysis demonstrates that FSA data at batch level need to be improved to provide reliable information on which producers can base their decisions. The lack of agreement between the two systems and the higher prevalence of lesions recorded in the BPHS system may suggest that for the animal health purpose the BPHS system performs better, probably because BPHS assessors are focused on specific animal health-related lesions while FSA ante and post mortem inspection primarily aims to protect public health and meat quality.

Conclusion

Routine meat inspection data has potential for animal health surveillance purposes but it needs significant improvement, if it is to replace the BPHS.

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