

# From field evidence to policy change and back again: risk mitigation measures at pig slaughterhouses

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## Abstract

The primary surveillance purpose of meat inspection is for food safety and protection of human health; however, it also contributes to animal health and animal welfare. Increasingly there has been doubt that use of traditional meat inspection systems, using incision and palpation, do not adequately mitigate current risks, especially in the context of food-borne zoonoses. Change has, of course been subject to barriers and constraints. Implementation of Regulation (EC) 854/2004 - which allowed pigs that were reared from birth in controlled housing, from integrated systems, to undergo visual inspection only - was hindered in the United Kingdom (UK) due to logistical difficulties at slaughterhouses. In order to gather the evidence needed to describe the occurrence of the health hazards and to contribute to the planning, implementation and evaluation of risk mitigation activities, a range of systematic approaches were required. These included data collation, analysis and interpretation; a field trial; qualitative risk analysis; social science methodologies and policy advice and expertise. A wide range of personnel, skills and disciplines were involved. The methodologies used for this complex science-policy-field interface cycle are described in this paper, as are their outcomes. They highlight the need not only for a two-way street between science and policy but the requirement for both multi-disciplinary and inter-disciplinary research to aid risk management decisions, break open the silos and thus ensure that effective surveillance systems are in place in UK pig slaughterhouses.

**Keywords:** *evidence, slaughterhouse, pig, legislative change, evaluation*

## Introduction

The inspection of live animals, their carcasses and offal at slaughter houses plays a vital part in surveillance to ensure safe food, protect human health, identify animal welfare issues and monitor conditions that affect animal health. For the European Union (EU) inspection procedures were detailed in Regulation (EC) 854/2004. This Regulation included a legislative provision for pigs that have been reared from birth in controlled housing, from integrated systems, to undergo visual inspection only, rather than the traditional method based on incision and palpation. This provision was based on the expectation that pigs from these systems are likely to have lower levels of pathology and so to be of less risk than other systems and therefore they could undergo

a less invasive inspection procedure. However, uptake by the UK pig industry was low. This was due to difficulties encountered because some slaughterhouses accept a mixture of batches of indoor and outdoor reared pigs throughout the day. The latter still needed to be inspected by traditional means and logistical slaughter was considered impractical.

An initial desk-based qualitative risk assessment (1) of the comparative risks to public and animal health from visual inspection of indoor and outdoor pigs concluded that the risk of changing inspection method was negligible for all pigs. In order to enhance the evidence-base for policy development, the Food Standards Agency (FSA) in UK funded research to investigate the implications of changing the inspection method, from the traditional method to a visual-only method, for fattening pigs from non-controlled housing conditions in the UK (FS145003 (2)).

Eventually, in 2014 the Commission Regulations (EU) 218/2014 and 219/2014 led to the implementation of visual inspection for all pigs at EU level. This was followed by changes to the legislation governing official controls in British pig slaughterhouses. Three areas of official controls were affected: traditional inspection was replaced by a more risk-based, visual assessment; the threshold for *Salmonella* testing and subsequent corrective action changed, as did the requirement for *Trichinella* testing. The FSA then commissioned an evaluation of the implementation of the legislative changes (FS101112) (3).

The methodologies used in this science-to-policy cycle are described in this paper. They highlight the need not only for a two-way street between science and policy but the requirement for both multi-disciplinary and inter disciplinary research to aid risk management decisions.

## Materials and methods

A baseline of the expected frequency of conditions to be found at ante-mortem inspection (AMI) of live animals, post-mortem inspections (PMI) of carcass and offal inspection was established for both fattening pigs from free range systems (fattened outdoors) and indoor fattening systems. Estimates were derived from the analysis of data from one pig-only abattoir in the east of England during the period January 2010 to December 2011.

A field trial was run in the same abattoir in five separate weeks of work during the period from November 2011 until April 2012. Every carcass of fattening pigs from non-controlled housing conditions was inspected using both post-mortem inspection method (traditional and visual-only inspection). The number of carcasses affected by each condition was recorded at a batch level for each inspection method. The type, frequency and distribution of conditions detected by both post-mortem inspection methods was established and then compared. The pairing of the observations was accounted for in the analyses. Similar to the baseline analysis, the effect of season and farm of origin were considered.

Samples were taken for microbiological investigation to compare visual-only inspection and traditional inspection. These investigations included total aerobic plate count, Enterobacteriaceae count and *Salmonella* and *Yersinia* spp. isolation.

The outputs of the field trial were used along with previous work, scientific literature and publically available information to do a formal, mostly qualitative, risk assessment (RA), based on guidelines described by the Codex Alimentarius Commission. The risk question was how would the risks to human (public) health, animal health and animal welfare change if visual-only inspection for fattening pigs from non-controlled housing conditions was to be introduced. The experience of those involved in the field trial was also collated to identify the obstacles that might exist to implementation of visual-only inspection for fattening pigs within UK abattoirs.

These studies contributed to the evidence-base for policy development and legislative change. Once the legislative changes were in place (June 2014) an evaluation of the implementation of visual-only inspection for fattening pigs within UK abattoirs was commissioned. This included: the development of an analytical framework - using a Theory of Change (TOC) approach to define the pathways through which the new legislation would lead to a number of outcomes and impacts and whether these would occur in the immediate, medium or longer term; the development of a monitoring framework – measures that could act as indicators to monitor outcomes and impacts associated with the new legislation were identified through desk research and epidemiological expertise. Critical analysis of the pros and cons of each one, in terms of data collection, management, analysis and interpretation was supplemented by semi-structured interviews with data managers and industry representatives. Shortlisting of measures was based on whether they mapped to the TOC model and an overall assessment of suitability. Finally a Red/Amber/Green rating was applied. In addition, a process evaluation was conducted in three waves of case study visits to pig slaughterhouses during the period May 2014 to November 2015. These visits were made to a number of carefully selected pig approved slaughterhouses, both pre implementation and on a further two occasions post implementation of the new legislation.

## Results

The analysis of the slaughterhouse data utilised the records of more than 1.2 million pigs from approximately 7,400 batches (the groups that they are submitted to the abattoir in). These pigs came from both indoor and outdoor rearing and fattening systems. The prevalence of conditions detected on inspection of pigs submitted to slaughter from different fattening systems were quite similar. Most of the differences found were predictable from knowledge of the housing and fattening systems being used and the relationship with the diseases, or circumstances from which the conditions arise.

In the field trial, more than 11,000 carcasses of fattening pigs from non-controlled housing conditions from 62 batches and 12 farms were inspected. There were statistically significant differences in the frequencies found by the two inspection methods for six of the categories of conditions. However, the biological differences were very small. The frequencies were higher with the visual method of detection for hair contamination. The frequencies were higher with the traditional method of inspection for milk spots, renal pathology, enteritis, pluck pathology and faecal contamination. No *Salmonella* spp. were isolated from any sample in the study (n=800; 400 for each inspection method). Also no statistical difference was found in the proportion of carcasses contaminated with *Yersinia* spp. after the two inspection methods. Although there was no evidence for a difference in the general bacterial contamination of carcasses after the two inspection methods, for carcasses where Enterobacteriaceae were present there was some evidence that the level of contamination of carcasses was lower after visual-only inspection compared to traditional inspection.

In the RA of the five public health hazards that were assessed (endocarditis, granulomatous lesions, *Salmonella* spp., *Yersinia* spp., and the hygiene process indicators - total aerobic plate count and Enterobacteriaceae count), only two have a revised risk on a change in inspection method; the risk associated with endocarditis (inflammation of the internal lining of the heart), changed from negligible to non-negligible i.e. very low; and, it is possible that the risk of microbial cross-contamination between carcasses was reduced. Only two animal health hazards were identified and assessed (endocarditis and granulomatous lesions). Again, endocarditis has a revised risk on a change in inspection method from negligible to non-negligible, i.e. very low.

Despite the revised risk classification for public and animal health attributable to endocarditis, the fact still remains (from previous work) that outdoor pigs from non-controlled housing conditions present at least the same, if not less of a risk than indoor pigs from controlled housing conditions for this problem. Visual inspection is acceptable for indoor pigs from controlled housing conditions; therefore, there was no reason relevant to the public health risk presented to exclude fattening pigs from outdoor, non-controlled housing conditions purely on grounds of the management system from which they originate.

There was also no reason for the exclusion of such pigs from a visual inspection system due to the revised risk to animal health. This is because action by producers is unlikely to be taken on the basis of information received about endocarditis lesions from post-mortem data feedback. It was possible that a change in the inspection method from traditional to visual would lead to reduced microbial contamination of carcasses in any abattoir with a level of contamination as low as or higher than the study premises. If the level of contamination of carcasses is reduced by a change in inspection method, then it could be hypothesised that the potential for cross-contamination would also be reduced; however, that was not a conclusion that could be drawn from this study.

In the field trial, the major obstacles to implementation of a visual-only system of inspection that encompassed pigs from non-controlled housing conditions ('outdoor') in the UK that were identified were the same as those that were expected if visual-only inspection were to be implemented for fattening pigs from controlled housing conditions.

In the evaluation of implementation, the major issues identified via the process evaluation were to do with communication: timeliness, effectiveness, interpretation and translation into practice. The pre-implementation visits identified that those directly affected by the change had heard of it, although there was very limited awareness of how the changes would work in practice. Indeed, most plants saw the change as a technical matter for meat inspections and felt that when the time came, the change would happen more or less overnight. While pre-trial communication could have been better, this did not seem to deter implementation. However, due to issues such as handling during the chilling process and in dispatch the qualitative evidence was inconclusive as to whether the change had reduced carcass handling.

Thirty-one potential measures were identified for the monitoring framework; however, only eight were shortlisted for inclusion due to challenges associated with data quality and attribution.

## Discussion

An accepted definition of surveillance is "The systematic – continuous or repeated – measurement, collection, collation, analysis, interpretation and timely dissemination of animal health and welfare related data from a defined population that are used to describe health hazard occurrence and to contribute to the planning, implementation and evaluation of risk mitigation activities."<sup>(4)</sup> This can be a challenge to achieve practically on the ground, in the "real world".

The primary evidence realised partial change in the legislation (Regulation (EC) 854/2004) that was not practical for the industry to implement. Additional evidence was required to support further policy development. This could only be effectively achieved by collaboration between those with a range of skills that included data collation, quantitative epidemiological analysis, study design, project management,

qualitative risk analysis and microbiological expertise. However, these alone would not be enough. Sufficient knowledge of the working environment within abattoirs was needed in order to gain the respect, engagement and input of the staff working in the slaughter house doing the inspections. While this could be arranged by the funders, it also needed co-operation not only from the inspection staff but from the Food Business Operator too. Additionally, knowledge of the pig industry was required, as was clear communication between the project team and those commissioning the work. Thus, this first part of the cycle – science-policy took a multi-institutional, multi-disciplinary approach: bringing disciplines together to talk about issues from each of their perspectives. There was substantial collaboration, but each group maintained separation of their disciplines in that process. When the project was done, those microbiologists, epidemiologists, field trial inspection staff, meat inspectors, policy scientific advisors and industry representatives went back to their day jobs and started other projects.

The investigations to evaluate the implementation were a slightly different scenario. Led by a renowned social research institute (Ipsos MORI), the process evaluation part was pure social science, albeit in a multi-disciplinary environment. It brought together social scientists, policy social science advisors and those working in the slaughter house environment; whereas, the development of the monitoring framework required a more inter-disciplinary approach. The integration of contributions from social scientists, epidemiologists, data managers and industry experts led to a new way; one that could potentially be used to evaluate the implementation of the legislative change. At times this collaboration was challenging due to a number of factors, not least of which was how projects are managed and the differing approaches of policy advisors and project officers that are experienced in the different disciplines. However, this part of the cycle demonstrated that integrating complementary topic and methodological expertise can provide the evidence which funders need to inform their increasingly complex decisions. The final step in the surveillance process would, of course, be implementation of such monitoring.

## References

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## Acknowledgements

The FSA for funding and all participating personnel.