

# Remote meat inspection with digital devices in small-scale pig slaughter in Sweden

Kautto, Arja Helena and Comin, Arianna

## Background

Compared to many countries in the world, Sweden is a small country when it comes to meat production. In addition, 83% of the slaughter establishments are small-scaled, processing 12% of the overall slaughter throughput in the country. Post-mortem inspection (PMI) of carcasses of food producing animals, performed by official meat inspectors, is mandatory for commercial slaughter in the European Union. PMI must be done on site at the abattoir and involves a lot of travelling by the inspectors to reach the most remote abattoirs and game handling establishments. Extreme weather or other hurdles can therefore hamper or delay PMI, causing logistic problems and economic losses for the food business operators. Over the past years it has been investigated the possibility to rely on digital devices to perform PMI remotely. Such system must be user-friendly, secure, reliable and economically sustainable and should guarantee the main goals of PMI: food safety, animal health and animal welfare. The objective of this study was to investigate the feasibility of remote PMI in finishing pigs slaughtered at small-scale abattoirs.

## Materials and Methods

Remote PMI was performed by a meat inspector (the receiver) located in another city using a personal computer and a technical support person (the sender) using a Wi-Fi connected smartphone on site at the abattoir. The sender was filming the carcasses and organs at the slaughter line and streaming it to the receiver in real time. The outcome of remote PMI was compared to the regular PMI performed by five other meat inspectors at the abattoir on 1009 pig carcasses. In order to separate the variation in PMI outcome due to the technique (remote vs. regular) from the inter-rater variation (remote inspector vs. on-site inspector), a preliminary comparison exercise was set up, where 243 carcasses were individually and independently assessed by all inspectors on site. The performance of PMI was assessed by calculating the overall agreement beyond chance (Fleiss' Kappa) as well as the finding-specific agreement beyond chance (Cohen's Kappa) between inspectors.

## Results

In the preliminary comparison, 221/243 carcasses (91%) had only one finding and the remaining had two findings. The overall agreement among inspectors was 36% (95%CI: 29-43%) and the finding-specific agreement ranged from 11% for lung lesions to 45% for parasitic liver lesions. In the comparison between remote and traditional PMI, 969/1009 carcasses (96%) had only one finding and 40 (4%) had multiple findings (max 3 per carcass). The overall agreement between the remote inspector and the on-site inspectors was 54% (95%CI: 51-57%) and the finding-specific agreement ranged from 34% for parasitic liver lesions to 86% for abscesses. Our results confirms that there is a substantial inter-rater variability between meat inspectors. The outcome of remote PMI in comparison to regular PMI on site was at least as reliable as the outcome of regular PMI performed by different inspectors.

## Conclusions

Some findings in PMI are documented more consistently than others. This pattern can also be seen for PMI in other species and in bigger abattoirs. Other findings are more prone to subjective interpretation leading to a higher inter-rater variability. Sources of differences in professional judgement concerning different findings in PMI are both bias (i.e., the average error in judgments) and noise (i.e., the variability of error in judgments). We emphasise on-going training and information concerning risk of noise to meat inspectors in order to be able to reduce the noise and reach a more disciplined action. In addition, whenever possible, we suggest taking into account a second opinion to improve the precision of decisions.

The use of digital devices in remote PMI does not negatively affect the inter-rater reliability. We see that the development of new technical devices are going to support both food business operators and official control in meat chain and be an important part of the future meat safety assurance system.

In this context, remote PMI with non-expensive self-ware - such as smartphones - has an important role in the sustainability of PMI in small scale slaughter and game handling establishments located in geographically remote areas.