HEALTH 4 WEALTH

Health4Wealth- pilot trials for the pork industry and producer engagement and case studies

Draft Final Report
APL Project 2018/0034
APL Project 2019/0034

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South Australian Research and Development Institute
David Hamilton, Jessica Jolley
GPO Box 397
Adelaide, South Australia 5001

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Executive Summary

Starting in 2012, Australian Pork Limited (APL) has funded a number of projects aimed at improving the consistency, accuracy and uniformity of slaughter data that is provided to pig producers and their veterinary consultants to help drive herd health improvement. In 2017, APL collaborated with the red meat industry to obtain funding under the Rural Research & Development for Profit funding scheme to develop and improve abattoir data feedback systems for the main domestic meat species: cattle, sheep, goats and pigs. This became known as the Health for Wealth (H4W) program.

The first H4W project for the pork industry, APL 2017/004, reached stakeholder agreement (producers, consultant pig veterinarians, processors, veterinary regulators) on the most useful categories of abattoir data to collect and report, from a herd health perspective. The two H4W projects reported here, APL 2018/0034 and 2019/0034, aimed to trial the logistics of collecting, recording and reporting abattoir data on individual carcases in a minimum of six pork abattoirs. The projects also set out to further engage with stakeholders to resolve remaining impediments to the introduction of a national abattoir data feedback system, and where possible, develop four on-farm case studies illustrating the value of the H4W data.

Trials were initiated at two export plants utilising radio-frequency identification (RFID) chips in the gambels to identify and track individual carcases on the slaughter floor. At one plant, input terminals at three inspection points (carcase, viscera and retain rail) enabled three sets of pathology and consequence data to be collected and uploaded to SARDI via the cloud, using a Marel software system. At SARDI, data were processed, analysed, and entered into a H4W database. The second plant only utilised an input terminal at the retain rail, which allowed carcase and consequence data to be collected and entered into the H4W database, but not viscera data. The trial at both plants has continued with some modification till the present.

A stand-alone, tablet-based, data recording and uploading system was developed in collaboration with Marel, an international software company, to allow plants without RFID technology or appropriate data entry terminals, to participate in the trials. Unfortunately, Covid restrictions (often processor initiated) have to this point made implementation of trials for this system impossible. It is recognised that defect data collection on an individual carcase basis may not be possible in plants without RFID or a similar carcase tracking system to collate data input from the various inspection input points. Trials will show how feasible this is and how useful data collated by lot number is as an alternative. Should Covid restrictions continue to make trial plant visits impossible through January and February 2022, it will be necessary to discuss with APL the options available for extending the H4W trial project further or trying to implement it remotely, with the accompanying risk of a less successful outcome.

An approachable, but informative, one-two page H4W data reporting template was developed for producers and processors. It presented the data in a largely visual format, minimising the need to wade through pages of tables or spreadsheets. The feedback on the format from producers, processors and veterinary consultants has been universally positive.

Covid restrictions, throughout the trial period, severely limited the possibility for face-to-face stakeholder engagement. Therefore, extensive use was made of online presentations to individual stakeholders to: explain the H4W system's operation; discuss the potential benefits for both producer and processor that it could provide; assess the interest in the ongoing supply of data; obtain feedback on the reporting template format; recruit candidates for possible case studies.

Overall, there was strong support for the H4W feedback system and a belief in the value of the data collected when assessing the extent of on-farm issues. It was clear however, that to realise its full potential in early detection of developing herd health problems, thereby permitting early implementation of treatment or controls, the report must be available within a few days of slaughter.

It was also clear that there is an immediate need for firm data governance rules to be developed, and that all stakeholders need to be included in their development.

Table of Contents

List of Figures

List of Tables

1. Background to Research

The operations of export accredited pork processing establishments are regulated by the Australian Government through the Department of Agriculture, Water and the Environment (DAWE). As part of the Pork Australian Meat Export Inspection System (Pork AEMIS), DAWE maintains a de-identified database on total carcase condemnations of pigs for verification and market access purposes, with data currently entered separately to that of the abattoir by the on-plant veterinarian (OPV). However, data on partial and offal condemnations have not been captured by processors in a consolidated, standardised, and systematic manner and this represents the greatest product and financial loss to both producers and processors.

Whilst some establishments have recording systems in place, either manual or electronic, the capability of personnel responsible for data collection on the slaughter floor and feedback of information to producers varied greatly between establishments. Furthermore, the reporting of abattoir disease-related partial and total carcase and/or offal condemnation data back to producers often occurred infrequently and the format and amount of detail varied considerably between processors. It was therefore difficult to utilise this information to support industry initiatives such as reforms in carcase inspection, verification, and animal health certification procedures, in order to improve animal health status and identify/support alternative risk management procedures. The lack of equivalence in the data collected between establishments, with regard to both the conditions recorded and the terminology used, also presented difficulties for producers to implement changes to on-farm management strategies in order to address animal health issues identified both prior to and during processing.

The project '*Enhancing supply chain profitability through reporting and utilisation of peri-mortem information*' (hereby known as 'The Health4Wealth Project') aimed to develop a standardised approach to data collection on disease-related carcase and offal condemnations and a nationally agreed, consistent feedback system to producers. It is envisaged that the new system will allow producers to monitor disease prevalence in their livestock and make informed decisions to maximise financial yield outcomes. Furthermore, modelling indicates financial benefits would be realised by the processing sector with reduced wastage. A standardised approach will also provide the data to support on-going risk assessment of inspection procedures.

The Health4Wealth Project (H4W) is one of the seventeen projects funded by the Commonwealth Government under Round 2 of the Rural Research and Development for Profit Program. The objectives of the Health4Wealth Project are to:

- Develop a business case for a peri-mortem data capture and reporting system that meets the needs of stakeholders across the beef, goatmeat, sheepmeat and pork supply chains.
- Develop standards and software that can be used to collect and consistently report disease-related carcase and offal condemnations (total and partial) during ante- and post-mortem inspection.
- Conduct validation studies to identify challenges or barriers to implementation and recommend solutions prior to rollout of the national system.
- Implement a national extension and adoption strategy to allow standardised data collection and reporting systems to be integrated into Australia's beef, goatmeat, sheepmeat and pork supply chains.
- Provide data to support on-going risk assessments of inspection procedures.

Previous related APL research projects

The type and scope of the feedback that pig producers receive for the animals they sell for slaughter are limited. Feedback ranges from minimal (e.g. condemn certificates) to quite extensive (e.g. prevalence of pleurisy). Partial condemns, often indicative of herd health issues, were generally not reported.

Therefore, prior to this H4W funded project, APL funded several preliminary projects to better characterise the need for enhanced abattoir feedback.

A 2012/13 workshop (APL Project 2012/2400), included producers, processors, consultant veterinarians and state/federal authorities and concluded that a uniform recording system for abattoir inspection findings held significant benefits for all stakeholders. These included providing herd health data, reducing the number of sub-standard slaughter animals (and the associated processing cost) and enhancing the confidence of regulators and overseas authorities in Pork AEMIS.

In APL Project 2013/2417, consultations were held with state veterinary authorities and processors to capture their current system, assess their degree of support for a change and identify concerns more accurately. State and Commonwealth veterinary authorities showed interest in the development of a national abattoir database, and offered their support. Processors recognised the value of such a system, both to themselves and the Australian industry.

APL Project 2015/2209 used operational and financial data from the seven export processors to calculate the cost associated with abattoir interventions to deal with sub-standard pigs. The potential gains for processors and producers were conservatively estimated at $5.70M annually, which does not include the production gains associated with the improved growth performance of affected pigs. The project identified the lack of a common language/definition to describe defects as the single biggest impediment to an effective uniform feedback system.

APL Project 2017/004 identified key animal health conditions that abattoirs should report to producers, giving farmers an opportunity to initiate on-farm decisions to improve productivity/profitability through better animal health management. An extensive stakeholder workshop developed the standardised recording process and discussed obstacles to implementation. The recommendation was for trials to pilot the recording process.

This project, APL 2018/0034, funded under the Health4Wealth Project, aimed to trial abattoir data collection under the core list of disease conditions determined by APL Project 2017/004 at a number of different sites, investigate logistic issues and develop a draft reporting format for producers and processors.

2. Objectives of the Research Projects

The project objectives were to:

1. Trial the standardised process of recording animal health conditions in a minimum of six pork abattoirs
2. Update stakeholder response and impediments to the introduction of a national feedback system
3. Deliver three-four producer presentations as producer engagement for the Health4Wealth project
4. Write anonymous case studies of how the feedback of animal health data has or can have an improvement on herd health and hence, producer profitability

3. Introductory Technical Information

Historically, the type and scope of animal health feedback that pork producers receive for the animals they sell for slaughter are relatively limited. As feedback is at the processor's discretion, it can range from minimal (e.g. condemn certificates) to quite extensive (e.g. prevalence of pleurisy). Partial condemns, often indicative of herd health issues, are generally not reported. The pork industry identified this as a data gap and APL has recognised this area as a research priority since 2012.

A workshop, conducted in 2012/2013 as part of APL Project 2012/2400, included producers, processors, consultant veterinarians and veterinary authorities (state and federal) and concluded that a uniform national recording and feedback system for abattoir inspection findings held significant benefits for all stakeholders. These included providing ongoing herd health data which is of great potential value to the producer and the consultant veterinarian, reducing the number of sub-standard slaughter animals (and the processing cost associated with that) and enhancing the confidence of regulators and overseas authorities in Pork AEMIS.

In APL Project 2013/2417, further consultations were held with state veterinary authorities and processors to more accurately capture their current system, assess their degree of support for a change and identify concerns they felt needed addressing that would impede implementation. State and Commonwealth veterinary authorities, faced with dwindling surveillance resources and increasingly being challenged by overseas authorities to back up their certification claims with data, showed a great deal of interest in the development of a national abattoir database, and offered their support. Processors recognised the value of such a system, both to themselves and the Australian industry more broadly. Overall, the processors gave in-principle support but required a robust cost-benefit assessment.

Hudson and Hamilton (2016) (APL Project 2015/2209) used operational and financial data supplied by the seven export pig processors (representing approx. 80 to 85% of the Australian pig kill) for four months (over a twelve month period to capture seasonality) to calculate the true cost associated with abattoir interventions to deal with sub-standard pigs (lost production, overtime, product loss, etc). In total, the potential gains for processors and producers was conservatively estimated at $5.70M annually, which does not include the production gains associated with the improved growth performance of affected pigs. The project identified a number of key impediments to establishing an effective standardised data collection system:

- The inconsistency in the format in which data were recorded by processors;
- The lack of consistency in the terminology applied to various causes/defects and carcase components which required intervention;
- The inconsistency in the scope and frequency of intervention information recorded along the slaughter chain.

For example, Figure 1 shows the stark difference in the establishment recorded data on the major carcase defects leading to slaughter floor interventions, collected for the same four-month time period. One establishment collected data on seven conditions, while at the other extreme, another establishment collected data on 42 conditions (Table 1). Reasons for the abattoir differences in the conditions for which data were being collected include the lack of a standardised recording system and variation in recording language and defect definition.

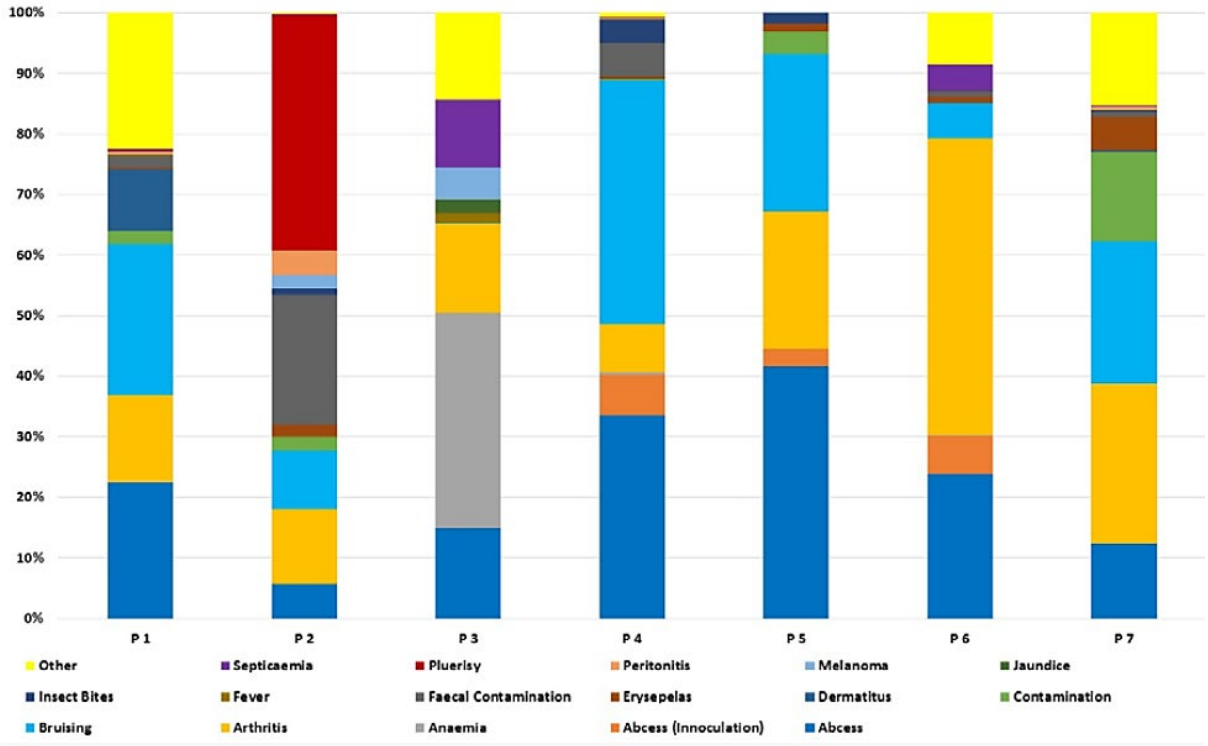


Figure 1: Variation between the seven pork export establishments for recorded major carcase defects leading to intervention (full or partial condemn) over same four months.

(Source: Hudson and Hamilton, 2016; APL project 2015/2209)

Table 1: The range of conditions recorded by the seven pork export establishments over the same four months.

Cause or Defect Present on Carcass x Processor						
Plant 1	**Plant 2**	**Plant 3**	**Plant 4**	**Plant 5**	**Plant 6**	**Plant 7**
Abscess	Abscess	Abscess	Abscess	Abscess	Abscess	Abscess
Adhesion	Abscess Multiple	Anaemia	Anaemia	Arthritis	Anaemia	Abscess Multiple
Anaemia	Arthritis	Arthritis	Arthritis	Bruising	Arthritis	Anaemia
Arthritis	Bile Contamination	Bruising	Broken Bone	Erysipelas	Bruised	Arthritis
Bile Contamination	Bruising	Fever	Bruising	Gross Contamination	Cancer	Broken Pelvis
Bruising	Erysipelas	Jaundice	Contamination	Inoculation Damage	Ecchymosis	Broken Ribs
Cancer	Faecal Contamination	Melanoma	Emaciation	Insect Bites	Emaciation	Bruising
Contamination	Fever	Septicaemia	Erysipelas		Erysipelas	Cancer
Cooked	Fight Marks	Other	Inoculation Abscess		Folliculitis	Contamination
DCARC	Insect Bites		Insect bites		Fever	Dermatitis
Dermatitis	Major Pleurisy		Peritonitis		Faeces	Erysipelas
Ecchymosis	Mange		Phimosis		Gangrene	Faecal Contamination
Emaciation	Melanoma		Pleurisy		Granuloma	Gangrene
Entertrytis	Minor Pleurisy		Pyaemia		Jaundice	Jaundice Icterus
Erysipelas	Peritonitis		Septicaemia		Melanoma	Mosquito Bites
Faeces Contamination	Septicaemia		Toxaemia		Pyaemia	Peritonitis
Fever					Septicaemia	Pyaemia
Fractures						Septicaemia
GC						Insect Bites
In-bleed						Peritonitis
Jaundice						Polyarthritis
Milk						Pyaemia
Multi Abscess						Pyrexia (Fever)
Oedema						Septic Pneumonia
Oil						Septicaemia
Other						
Peritonitis						
Pleurisy						
Polyarthritis						
PSE						
Scar						
Sebaceous Cyst						
Semen						
Septicaemia						
Septic W						
Skinless						
SPNEUM						
Tail Bite						
Tumour						
Uraemia						
Urine						

(Source: Hudson and Hamilton, 2016; APL 2015:2209)

During the 2017 MINTRAC Meat Inspection and Quality Assurance Managers Network regional meetings and Conference, quality assurance (QA) staff from pork establishments were surveyed as to their opinion on the importance of various diseases. QA staff were given a virtual $1,000 to allocate to various diseases, with the objective of investing in and spending money to reduce the diseases considered to have most importance and effect. The $1,000 could be split into smaller amounts, to distribute funds more widely if desired. The results of this exercise run by MINTRAC and Dr Joan Lloyd are shown in Table 2. The top three conditions for pigs were arthritis, pleurisy and abscesses.

Table 2: Conditions and the prioritised virtual investment identified by QA staff at the 2017 MINTRAC MI&QA meetings.

Condition	**Total**
Abscess	$2,000
Anaemia	$100
Arthritis	$3,400
Bile contamination	$300
Bruising	$600
Dermatitis	$100
Erysipelas	$1,400
Septicaemia	$250
Melanoma	$800
Peritonitis	$0
Pleurisy	$5,800
Other	$0
Total	**$14,750**

Drawing on this and the results of this previous research, APL Project 2017/004 developed, in collaboration with processors and other stakeholders, a common, more useful language to facilitate prompt and accurate abattoir feedback of reasons resulting in partial carcase and/or offal condemnation, to assist producers to improve their productivity through improved herd health surveillance.

The agreed data to be nationally collected was composed of both syndromic (gross pathology based) data and impact (consequence) data, as both can have a significant impact on the financial returns to both the processor and the producer. The agreed data set to be collected are shown in Table 3 below. Additionally, plants would retain the flexibility to add data categories in which they were particularly interested. From a surveillance perspective, veterinary authorities would also be able to request temporary prevalence data collection in categories of potential concern (e.g. haemorrhages indicative of possible African Swine Fever (ASF), vesicles indicative of Foot and Mouth Disease or Swine Vesicular Disease). Figure 2 below, illustrates a proposed model of how H4W could operate.

The APL Project 2017/004 workshop further determined that attempting to collect detailed severity data at elevated chain speeds would threaten the accuracy and integrity of the data. It was therefore concluded that rather than attempting to replace the Pig Health Monitoring Scheme (PHMS - an existing 3 monthly, 30 carcase/viscera monitoring scheme), the new H4W scheme (collecting data from every animal killed) would be most effective working as an overview system in conjunction with PHMS. Issues identified or flagged by H4W could be effectively investigated in detail using the existing PHMS capability.

Table 3: Agreed list of syndromic conditions and impact or consequence data for collection in all pork export establishments.

Syndromic Condition	Impact or Consequence Data
Abscess	Leg condemned
Anaemia	Forequarter / Hindquarter condemned
Arthritis	Side condemned
Ascarids	Backbone removed
Bruising	Liver condemned
Colitis	Carcase skinned – partial or whole
Contamination	Ribs removed
Dermatitis	Pleura stripped
Erysipelas	Pluck condemned
Fever	Intestines condemned
Ileitis	Overfull guts (contamination)
Melanoma	Total carcase condemnation
Nephritis	
Pericarditis	
Peritonitis	
Pleurisy	
Pneumonia	
Ante mortem (emergency kill reason / tail bite / hernia / orchitis)	

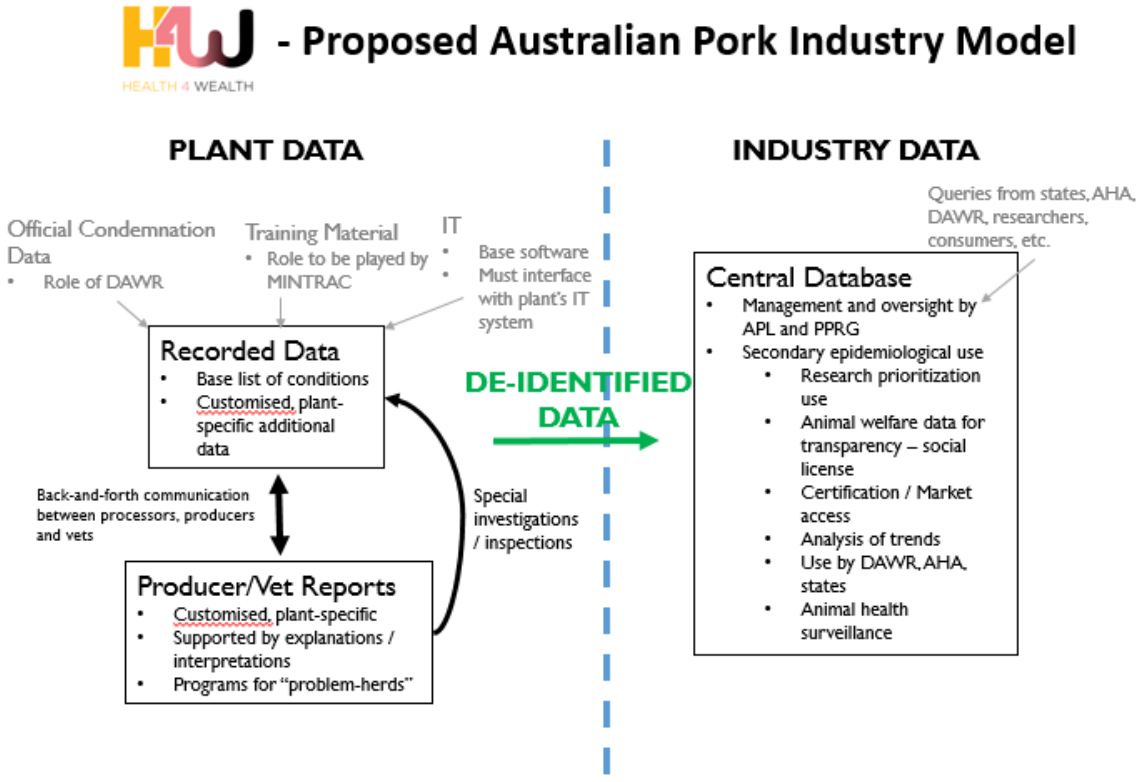


Figure 2: Proposed model for the use of the data collected as part of a standardised feedback system for animal health data.

4. Project Methodology

4.1 Methodology overview

The plan was to:
1/. Run the system at two export pig abattoirs for four months;
2/. After the initial four months, review the process and progress of the pilot trials, learning from readjustments and the ironing out of issues;
3/. Subsequently run the system in four different export pig abattoirs for four months.

Infrastructure upgrade requirements were assessed by David Hamilton prior to selecting the trial establishments and negotiated with management. Inspector training in the system was provided onsite by the researchers, in conjunction with Marel, and the reports generated regularly monitored by SARDI. The onsite training and monitoring, although time consuming, was deemed vital to the project's success.

Using a total of six different abattoirs would better assess the robustness of the system across Australia and provide feedback on the implementation of the system from as many different slaughter systems as possible. In the second round (alongside the four different export abattoirs), the H4W system would also be run in a domestic abattoir(s) for as long as they were willing to do so. Unfortunately, Covid enforced significant changes to this planned second round. As a result, it became necessary to request an extension until March 2022, to enable the researchers to visit the participating plants and provide the necessary implementation process.

Individual carcase data would need to be input at three different points on the slaughter floor: the carcase inspection station; the viscera inspection station; and the retain rail. The data from these three points would need to be collated and recorded against each carcase and uploaded to SARDI for analysis, entry into a database and formatting into reports for the processor and producer.

4.2 Trial considerations and challenges

For the H4W trials to be successful, there were a number of issues that needed to be considered:

- Who is best placed to collect the data?
- Can individual carcase data be sustainably collected at current chain speeds?
- How to match/correlate carcase inspection, viscera table and retain rail findings?
- How best to provide feedback to producers and processors?
- How useful is the data?
- Interaction with the current Pig Health Monitoring Scheme (PHMS)?
- Are additional data collection points required?
- How reliable/accurate is the data?
- How robust is the data recording system?
- Quality monitoring/ assessment – how would this operate?
- Training needs?
- Governance rules for data – how and where would it be stored? To whom and under what circumstances would access be granted?
- Other issues arising during the trials.

4.3 Selection of trial processors

It was determined that the initial trial at two processors should be undertaken at plants which utilised radio-frequency identification (RFID) to track carcases on the slaughter floor. This would simplify collating the individual carcase pathology/consequence data inputs from different parts of the slaughter floor. The RFID chip was embedded in the gambels, so travelled with the carcase along the chain.

Three processors have RFID capability: Swickers (Queensland), Diamond Valley Pork (DVP) in Victoria and Seven Point Pork (SPP) in South Australia. Swickers had an existing system of data collection and were therefore not interested in trialling a new one. Consequently, DVP and SPP were recruited to participate in the initial pilot trials.

4.4 Development and incorporation of data collection software

Marel, an international food industry software company with extensive abattoir experience, was contracted to develop appropriate software to collect the required slaughter data in collaboration with SARDI. Marel assisted the trial plants to incorporate the new software into their existing computer systems, an often-complex process, and provided ongoing IT support and advice to both the plants and SARDI throughout the trials. For the project, a reduced licence fee arrangement was negotiated by SARDI and paid for by the project – at the conclusion of the project, trial plants will need to negotiate a licence agreement with Marel, should they wish to continue.

4.5 Commencement of carcase data trials

Following several visits to both plants, discussions with management, and presentations to meat inspectors, OPVs, and Australian Authorised Officers (AAOs), on-plant trials commenced in April 2019.

Initially data collection was restricted to carcase pathology identified at the first carcase inspection point, while logistic issues were identified and solved. Considerable effort was made by the researchers to ensure data were entered uniformly and reliably by inspection staff through regular phone calls, plant visits (approximately 6 per plant), meetings with management and inspection staff, data checking, and problem solving. The main issues were overcoming inspector reluctance to change their usual roles, representing sixty years of tradition. Older inspectors were not always comfortable with IT. Resolution took time and patience – explaining the changing face of inspection internationally (moving to visual only) and the increasing importance of good, reliable, accurate data for herd health, animal welfare and trade purposes. The vital role that inspectors could play in H4W and the value they could contribute to the system were repeatedly stressed. They accepted that this was the emerging future face of meat inspection globally.

4.6 Commencement of viscera and retain rail data trials

Following the successful implementation of the carcase data collection trials, Marel and SARDI modified the Innova software to permit collection of data from the viscera table and the retain rail. This allowed the collection of not only identified syndromic conditions (e.g. colitis, pleurisy, pneumonia etc.) but consequence data (e.g. pluck condemned, leg removed, carcase skinned etc.). All data were able to be linked back to an individual carcase number by reference to the RFID number.

DVP had spare input terminals and with assistance from Marel agreed to install them and integrate the data collection at both the retain and viscera table. This turned out to be a difficult and time-consuming exercise, involving ongoing negotiations, but in February 2020 offal data collection commenced.

SPP decided against the expense of installing additional terminals at the viscera table and retain rail. They elected instead to attempt to link their RFIDs with the stand-alone tablet option in development by Marel and SARDI, intended to be used by those pig processors without sophisticated data collection computer programs.

Unfortunately, it proved infeasible to link the two systems so SPP therefore elected to continue with carcase data input but to forgo inputting viscera and retain rail data for the present.

4.7 Transfer of data to SARDI for processing and storage

Data spreadsheets are provided to SARDI on a regular (daily) basis from the participating plants. The data are analysed using the statistical software package R (https://www.r-project.org/) and code has been developed by SARDI to transform the plants' data spreadsheets into a format that is compatible for further analysis.

A number of reports (producer and processor) are then generated from the data using R and the Sweave package to make this process as efficient and streamlined as possible.

4.8 Development of report format for feedback to processors and producers

Collecting individual data on each carcase and set of viscera generates large data sets. One week's data can run to over 250 pages of tables, depending on kill numbers. It was felt, however, that sending out pages of tables and spreadsheets would be unwieldy and run the risk of being ignored by busy people.

The aim, therefore, was to design a report format such that the processor, the producer and the veterinarian could readily interpret the overall findings with little effort. Health and disease issues needed to be highlighted so they could be readily detected and concerning trends identified, with minimal searching for detail.

4.9 Development of stand-alone tablets for data input

Four of the seven export pig processors do not use RFID technology to track carcase movement on the slaughter floor. A data entry system using stand-alone computer tablets was developed by Marel that could be utilised at the three inspection data entry points (carcase, viscera, retain rail). This system does not require connection to or utilisation of the processor's on-plant computer system but does require an internet connection in order to upload data directly to the cloud.

Prior to this project's commencement, several local and interstate plants (including domestic) were visited and gave in-principle agreement to further investigate the on-plant logistics of trialling the stand-alone tablet system. It was recognised that the logistics and challenges would be quite different to those on plants with RFID tracking: could data collected from three different inspection points (carcase, viscera, retain rail) be accurately correlated; could data still be collected on an individual carcase basis or would reporting need to revert to a line or batch basis?

Unfortunately, planned follow-up visits to plants became impossible, due to the implementation of Covid restrictions by processors (often stricter than state border or internal jurisdiction controls). As a result, the on-plant trialling of the stand-alone tablet system had to be indefinitely suspended. Currently two interstate plants (Rivalea in NSW, Linley Valley in WA) have been waiting for over six months for Covid restrictions to lift, so SARDI can trial components of the stand-alone system: one plant elected to commence with carcase data collection; the other with offal data collection.

4.10 Updating stakeholder response and facilitating a national data collection uptake

Initially, a series of regional stakeholder meetings and workshops were planned, with the aim of bringing producers, veterinarians and processors together, to explain the data collection and analysis, and to discuss and/or modify the reporting formats. A successful meeting was held in Mount Gambier with the TOP pig group in October 2020. However, increasing Covid travel and meeting restrictions made face-to-face workshops and stakeholder meetings difficult, and in some cases impossible, to arrange. It was therefore decided to utilise online presentations with individual processors, producers, pig veterinary consultants, retailers, veterinary regulators, and other interested parties from 2020 onwards.

In total, over 30 on line presentations have been given. Details are included in Appendix 1; however, the overall response was overwhelmingly positive with all stakeholders (without exception) recognising the value of a national, uniform, accurate, transparent system of abattoir data collection, with appropriate confidentiality protections.

4.11 Anonymous case studies demonstrating effective use of H4W data

Veterinary consultants and their producer clients who sought H4W data, were asked if they would agree to be written up as anonymous case studies, if the data proved useful in resolving herd health issues. Although readily agreeing to that request, the nature of the trials meant that the data was generally sought once the producer or their veterinarian had already become concerned about an issue.

It became clear from feedback during the trials, that whilst the historical slaughter data were useful to confirm the extent of an identified problem, if H4W was to reach its potential for early identification and control of developing issues, the information had to be available almost immediately. The current lack of an immediate universal H4W data dissemination system to producers, meant that developing true case studies, (i.e. where H4W alerted producers to an unknown problem; led them to contact their veterinarian; which in turn resulted in a successful intervention) proved unachievable. None-the-less, the usefulness of the data is illustrated in section 5.5 and Appendix 1.

5. Project Outputs

5.1 Who is best placed to collect data?

It was decided that meat inspectors are currently the most appropriate individuals to collect the data for the trials:

- They are the ones commonly used overseas for this function.
- They have the training to identify pathology.
- They are the ones making disposition decisions (i.e. determining appropriate interventions).
- Proposed changes to inspection procedures to move to visual inspection, as has already occurred overseas, will:
    - Potentially free up inspectors' time for other tasks.
    - Provide an incentive to participate.

Ongoing discussions were held with the inspectors and management at both trial plants, in the leadup to and during the trial. The project background and aims were outlined in detail, along with the significance and value of the role they could play in providing data that could improve both herd health and farmer returns. The importance of accurate data collection was stressed, as was the impact inaccurate data would have on the credibility and continuation of the scheme. These discussions and interactions proved key, and inspectors were generally enthusiastic about their changed role, continuing to offer insights and suggestions for improving the system. Their involvement and commitment have proved to be integral to the success of the trials.

5.2 Can individual carcase data be sustainably collected at current chain speeds?

With appropriate use of technology (touch pads, RFIDs, appropriate programs) and training, the evidence from the trials is that yes, individual carcase data can be sustainably collected at current chain speeds.

Diamond Valley Pork (DVP)

Diamond Valley Pork (DVP) is a Melbourne export licenced abattoir that has had significant upgrades in recent years, enabling it to increase chain speeds and throughput. At the commencement of the trial, DVP were processing 460 pigs/hour, but that increased to 620/hour during the trial period.

DVP uses RFIDs embedded in the gambels to track individual carcase movement in their establishment and several input terminals on the slaughter floor to enter data. As part of the trial, DVP agreed to install a new terminal at the viscera table, to enable offal data to be collected.

At 420 pigs/hour DVP had no problem routinely inputting the carcase and viscera data. In October 2020, a significant upgrade to the slaughter floor was undertaken, which included moving the viscera table, and increasing the throughput to 620/hour. The touch screen at the viscera table has not yet been replaced, but DVP has continued to successfully collect carcase and retain rail data at the faster speed. It is expected that the viscera touch screen will be re-connected in the near future (as per recent management communication). Recognising the value of producer feedback, DVP have expressed the intention to continue data collection into the future. However, further modifications to data collection may be required when DVP further increase their chain speed in the future.

After considerable efforts by both Marel and the DVP IT section, the Marel software was able to interact seamlessly with the DVP system, with minimal issues. H4W slaughter data was therefore

entered at three inspection point terminals on the slaughter floor: primary carcase inspection; viscera inspection; retain rail inspection. The three data sets were uploaded or sent daily to SARDI where the data were correlated and linked to an individual carcase using the RFID number.

At the primary carcase inspection point, a designated senior trimmer stood adjacent to the two meat inspectors and entered any identified conditions on the touch screen at their direction. At the viscera inspection point, one of the two meat inspectors operated the touch screen. At the retain rail, the single meat inspector entered both the condition and the associated intervention/impact/consequence data (e.g. leg removal, etc).

Trial plants collected a core group of conditions and impact or consequence data (Table 3). In addition, the Marel/SARDI software design gave plants the flexibility to add additional conditions of particular interest to them. The DVP touch pad input buttons are shown in Appendix 2. Note additional data entry buttons for milk spot and tuberculosis (TB) have been included at DVP's request.

Seven Point Pork (SPP)

Seven Point Pork (SPP) is an export licenced processor based in Port Wakefield SA. SPP's production speed varies between 290 and 400 pigs/hour, and they also utilise RFID technology to track carcase movement. SPP only has a data entry touch screen at the retain rail inspection point, so they are unable to collect viscera data (touch pad input buttons are shown in Appendix 2). Although the buttons vary from the DVP setup, the data can be readily distributed or combined into the H4W categories in Table 3, enabling comparable producer and processor report summaries to be generated by SARDI.

SPP investigated installing an additional integrated fixed touch screen at the viscera point but decided against it due to the expense. They elected to instead work with Marel to set up a stand-alone tablet with an associated RFID reader for collection of viscera data. Unfortunately, it proved extremely difficult to integrate the existing SPP in-plant slaughter floor software and RFID reader output with the Marel data entry software, despite discussions with the parent software company in Denmark. There were possible solutions proposed, but they were expensive and beyond the funding available in the project.

SPP have been able to maintain effective data collection and submission of carcase data for the last two years. Data is uploaded daily to SARDI where the data are correlated and linked to an individual carcase using the RFID number.

Swickers

Swickers is a large export licenced processor based at Kingaroy Qld. Swickers process 95% of Queensland pigs at up to 730 pigs/hour and have been collecting and reporting abattoir findings to producers for over six years. Data are automatically uplifted to their website and are available in real-time on their Extranet site. Producers (and their veterinarians if given permission) can log on to Extranet at any time.

Swickers utilise RFIDs to track carcases and collate data, which is entered after the polisher (tattoo numbers), at the carcase inspection point (carcase and offal data) and at the grading station (impact/consequence/intervention data).

Although Swickers have not participated in H4W up to now, after discussions/negotiations, they have agreed to contribute their data to the H4W database in return for receiving unidentified benchmarking data from the other plants.

The ability to relate pathology identified at both DVP, SPP and now Swickers to individual carcases has proved useful when investigating sub-clinical disease. It enables an individual pig's disease status to be directly correlated with their graded carcase weight. Without this ability, the impact of underlying disease on the growth performance of individual animals may easily be underestimated. Figure 3 shows an example of how RFID technology allows an individual animal's pathology to be related to their slaughter weight, providing a direct objective measure of disease impact on growth performance and thereby, producer financial return.

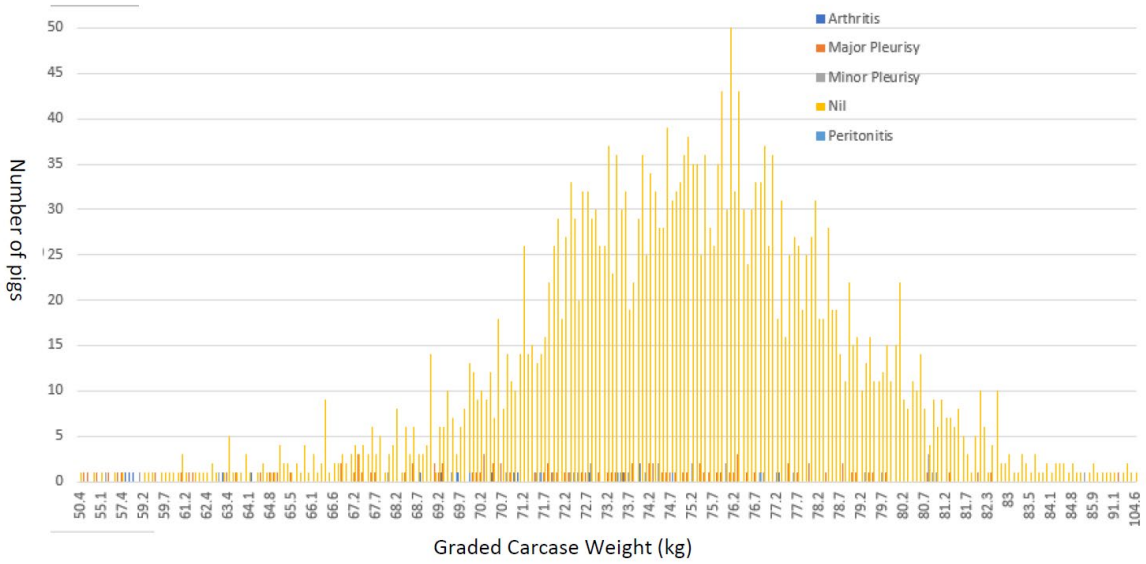


Figure 3: Arthritis and pleurisy appear to be associated with lighter carcase weights.

5.3 How to match /correlate carcase inspection, viscera table and retain rail findings?

When processors have RFID technology, it is a relatively simple matter to correlate data from different input stations with a particular carcase. This becomes much more problematic when RFID technology is unavailable.

Correlating viscera and carcase is generally achievable in licenced abattoirs, as that is a regulatory meat inspection requirement. Inspectors at the viscera table and carcase inspection points are expected to be able to communicate with each other when making disposition decisions. Retain rails, however, may be situated quite distant from the other stations. To collate individual carcase and viscera findings with the retain rail interventions/disposition on that same carcase, without RFIDs, would require individually numbered tags to be applied and recorded, which is considered impractical at normal chain speeds.

An alternative is to collate the data on a pig lot or line basis, rather than by individual carcase. While not as informative, H4W lot-based data can still provide more uniform, targeted and detailed disease and intervention/consequence data back to the producer, to assist in improving herd health, than is often currently available.

In conjunction with Marel, SARDI has developed a tablet-based system (three tablets have been purchased under the H4W project) that operates independently of the plants computer system. It can be used to record and upload the same information as the plants with RFIDs, but against a lot number as opposed to an individual carcase number.

Two plants have been waiting for at least six months to trial the tablets, one in NSW and one in WA. One of the plants will initially collect just carcase data, whilst the other will collect offal data. The data will be uploaded to SARDI, then processed and entered into a database. Unfortunately, Covid restrictions have made it impossible to commence the tablet-based trials as they require visits to the plants for support and training, particularly in the initial stages. All seven plants have agreed in principle to participate in the trials, but this will need to be confirmed once the stand-alone tablet trials have had their initial testing at the NSW and WA plants.

5.4 How best to provide feedback to producers and processors?

In consultation with processors, producers and veterinarians, it was decided that the most useful report format for feedback to producers was a one-two page report in which the data were presented visually where possible, minimising the need to wade through pages of tables or spreadsheets. It was also considered important that individual processors and producers were able to benchmark themselves against their peers, without compromising anonymity, an important aspect of the envisaged H4W system. The underlying detailed database would still be available to drill down into if more specific data were required. It was thought that reports could be prepared based on a rolling window of 13 weeks of slaughter data, providing enough information for developing trends to be observable. The 13-week period reflects current Pig Health Monitoring System (PHMS) reports.

Two different reports were designed and are presented in Appendix 3. The draft report template formats were tested and modified based on feedback from processors, producers, and pig veterinary consultants. Some 15 pig veterinarians and more than 30 producers have seen the report format, while approximately 10 producers (along with their consultant veterinarians) received individual report presentations for their own farms. The reports were well accepted and seen as user friendly, very informative, and valuable in identifying past and emerging pig health issues.

5.5 How useful is the data?

The general response from stakeholders was that data collected were very useful, provided it could be given in a timely manner. Historical data allowed recognition of past issues and could be useful in demonstrating the effectiveness of attempted interventions, however current data were important in alerting producers and their veterinarians to developing concerns, allowing timely control strategies to be introduced.

The independence and transparency of H4W have also proved useful in defusing potential producer/processor conflict. In one case for example, involving significant losses due to bruising (up to 10% prevalence), the H4W data allowed the producer to compare their bruising prevalence with all other producers killing in the same week. That showed that the producer's prevalence was considerably higher than that of their peers. This helped direct the focus of investigation from the on-plant pig handling to the on-farm and pig transport areas. Further investigation convinced the

producer that it was transport related, which in turn has led to the pursuit of several potential transport solutions.

Processors too, have shown a keen interest in the processor reports. Swickers/SunPork, who have their own slaughter floor data collection and producer feedback system, were given a detailed presentation on the H4W reporting system. The company was particularly interested in the inter-processor benchmarking ability provided by the report templates and as a result, contributed their data from several months to SARDI's H4W database for this exact purpose. Swickers/SunPork have expressed interest in continuing their involvement in the future.

5.6 Interaction with the current Pig Health Monitoring Scheme (PHMS)?

The H4W system was designed to work in conjunction with the existing PHMS, not to supplant it. The H4W program collects data from every individual carcase, cataloguing findings into broad categories (e.g. abscess, dermatitis, arthritis). By comparison, PHMS collects data periodically on only a small sample of a producer's pigs, and therefore, has the time and ability to delve deeper into severity and diagnosis. Both systems have an important role to play: the H4W program gives a broad overview of disease conditions presenting at slaughter; in turn, this helps direct PHMS interest and activity where it is most needed.

Covid restrictions have significantly affected the PHMS, with abattoir access issues resulting in many veterinarians currently being unable to obtain PHMS data. As a result, the SARDI research team has been regularly approached by consultant pig veterinarians with requests for H4W data for their producer clients to assist with herd health investigations. This has been achieved both by conducting on-line presentations to veterinarians and producers and providing relevant raw data sets where requested (after appropriate permissions have been obtained). This has been an important step in establishing the credibility and useability of the system.

6. Implications & Recommendations

- Issue 1
  After many one-to-one online presentations, the response from stakeholders to both the H4W data collection and the format of the reports has been overwhelmingly positive. Covid, however, has severely restricted the opportunity for large scale presentations face-to-face as in producer meetings, etc. Although effective, one-on-one presentations are a time-consuming way to reach a large audience, while online meetings with large numbers of participants make assessment of audience engagement difficult. If H4W is to gain widespread support for its continuation, it is important to reach and gain feedback from a greater number and wider range of stakeholders (see next issue).

Recommendation

That APL organise a number of H4W stakeholder meetings/workshops when Covid restrictions allow, where the investigators can present their findings in an interactive format.

- Issue 2
  Some retailers are now purchasing pigs directly from producers and slaughtering them at a variety of service abattoirs. An issue arose with Coles at a trial plant, as they contended that they: owned the pigs, so also owned/controlled any data collected; already sent some slaughter data to the

producer; were unaware that H4W existed; objected to H4W collecting, and in particular distributing, data directly back to their producers. The initial Coles reaction was to not allow H4W to continue to access the slaughter data. However, after the research team approached Coles and delivered a detailed presentation and follow-up discussions, Coles agreed to allow H4W to continue to access data from the trial plant.

The incident illustrated that the pig industry stakeholder group extends into the wholesale/retail area, which to a large extent, has been overlooked in the H4W communication process. It also underlines the need to develop governance rules for the data that are acceptable to a broad stakeholder group. One concern Coles strongly expressed was the possibility of the data being used mischievously to generate ill will between processors and producers.

Recommendation

That members of the wholesale/retail sector be invited to attend a forum (perhaps a PPRG meeting), where processors can communicate directly their support (or otherwise) for H4W. This would provide a demonstration of the strong support H4W enjoys and assist its acceptance by the meat marketing sector. The stakeholder group should also be expanded to encompass the meat marketing sector and include them in discussions and development of data governance rules.

- Issue 3

  H4W gave assurances to the industry that governance rules would be developed for the use and access to the data it collected. During the trial period, there have been questions raised by producers, processors, regulators and retailers regarding this issue. If H4W is to continue and to maintain and build on the credibility it has established with stakeholders, the incident with a major retailer referred to in Issue 2 above indicates that it is time to deliver on that assurance, and develop those governance rules in a timely manner.

Recommendation

That APL expedite a process, engaging all stakeholders, to develop data governance rules for the H4W system.

- Issue 4

  A significant factor in the ongoing acceptance and success of the H4W system, is the confidence that all stakeholders have in the accuracy, security and confidentiality of the data collected. Confidence in the trial data holders (SARDI) proved pivotal in resolving issues that arose during the pilot trials.

Recommendation

As part of the governance discussion, there should be consideration/agreement as to what organisation/s should be entrusted to maintain and operate a national database and how it would best be funded. NB. Some preliminary discussions between SARDI and APL have already been initiated.

- Issue 5

  Covid has seriously impacted the trial timetable, with the result that it is likely that trials will only have been initiated at four plants by the end of the H4W project rather than the six export plants

and one domestic plant anticipated. However, the feedback to the investigators indicates widespread interest among stakeholders to maintain and where possible, expand the H4W system to more plants. In addition, the time left to fully explore the practicality and effectiveness of the stand-alone tablet-based system is severely limited.

Recommendation

That APL consider supporting the continuation of the H4W trails to include additional plants, including domestics.

- Issue 6

  The H4W project has supplied ongoing assistance and feedback to processors, however the cost of structural and manpower change has been borne by the processor alone. The presence of RFID on a plant makes the accurate collection and recording of data a much more achievable and potentially allows the financial impact of disease on individual animal performance to be calculated for the producer, greatly assisting intervention/control decisions. Some stakeholder feedback has suggested that it may be in producer interests to use some producer funds to assist the wider processor take-up of RFID technology.

Recommendation

That APL consider the appropriateness and degree of member support for financially assisting RFID or similar technology take-up by processors.

- Issue 7

  Stakeholder feedback, although very favourable, emphasised that timeliness of access to producer data was key to the usefulness of the H4W system. Having the processor slaughter data analysed and readily available on a website protected by a producer password, was therefore the ideal solution. A producer could permit access to a veterinarian if so desired, within agreed governance rules.

Recommendation

That APL investigate the establishment of a website to host a national H4W database.

7. Intellectual Property

SARDI and the pork abattoirs retain ownership of the data collected and the Health4Wealth program retains the Intellectual Property of the data collection and recording system(s) developed for the Health4Wealth program.

8. Appendix 1: Stakeholder Engagement

Letter from SARDI to industry stakeholders at the start of the trials

At the commencement of the trials, the investigators sent the following 2-page explanatory letter to a wide range of stakeholders. This was requested by processors, to provide them with a simple way of responding to questions from interested parties (producers, retailers etc). It served as a useful introduction to the H4W project.

Health 4 Wealth (H4W) – pilot trials for the pork industry for a national abattoir to producer feedback system

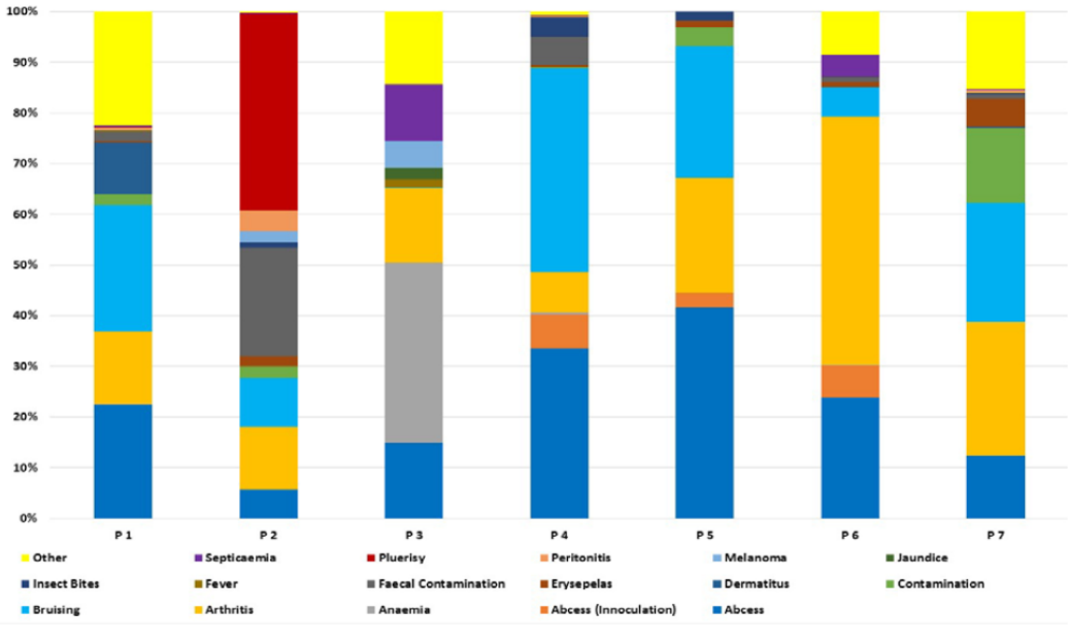
I am writing to provide a brief background and update to current industry R&D, following consultations with key stakeholders, to introduce a national abattoir feedback system for pig producers, providing disease information for every pig slaughtered, that can be used to improve herd health and thereby farm profitability.

APL has been funding research to facilitate the establishment of a consistent national abattoir feedback system to pig producers since 2012. The research has included surveying stakeholders, assessing impediments to the uptake of a national system and conducting a detailed cost: benefit study. Below is a bar graph (figure below) of conditions (defects) currently recorded by the 7 export pig plants (P1 to P7). Each column shows the results for a single abattoir collected over the same 4 months, with each colour representing the prevalence of a particular defect. For pigs killed at the same time but at different plants, you would expect the columns to look much more similar than they do. The graph illustrates the variability between abattoirs in current recording/reporting systems.

It is difficult to determine if the differences between the plants in pathology etc. are real differences between pig populations or just due to differences in abattoir recording definitions and language. On further examination, the number of individual conditions currently recorded by the seven export pig abattoirs varied from 7 to 42. The situation with regard to domestic abattoirs is currently unknown.

An agreed uniform national abattoir recording system should significantly reduce these discrepancies and help identify correctable on-farm disease and husbandry issues. Further, if data were able to be entered into a national de-identified database, it would provide a valuable resource to support Australia's minimal disease status and emerging welfare challenges.

Variation between establishments for recorded major carcase defects leading to intervention (full or partial condemn) over same 4 months



Health4Wealth Pork Industry Workshop

Hamilton and Hudson (APL 2015/2209)

Industry Stakeholder Workshop 2018

In 2016, Meat and Livestock Australia (MLA), representing beef, sheep and goats, partnered with Australian Meat Processors Corporation (AMPC) and APL to gain parallel Commonwealth funding to establish a national abattoir feedback system covering all domestic species. The project is known as the Health for Wealth project (H4W).

In March 2018, SARDI conducted a H4W workshop for all pork stakeholders (export processors, producers, pig veterinarians, veterinary regulatory authorities and researchers). At that workshop, there was in-principle agreement to investigate collecting data in a standardised format and language from all slaughter pigs under two data streams – syndromic and impact (consequence), as both have significant stakeholder financial implications (lists below). The data would be made available to producers to assist in improving herd health and represents the minimum base data for all 7 export plants.

Syndromic Condition

- Abscess
- Anaemia
- Arthritis
- Bruising
- Colitis
- Contamination
- Dermatitis
- Erysipelas
- Fever
- Ilietis
- Melanoma
- Nephritis
- Pericarditis
- Peritonitis
- Pleurisy
- Pneumonia
- Ante mortem(emergency kill reason / tail bite / hernia / orchitis**)**

Impact or Consequence Data

- Leg condemned
- Forequarter / Hindquarter condemned
- Side condemned
- Backbone removed
- Liver condemned
- Carcase skinned – partial or whole
- Ribs removed
- Pleura stripped
- Pluck condemned
- Intestines condemned
- Overfull guts (contamination)
- Total carcase condemnation

H4W Pilot Trials

The aim is to select two processors to run a concurrent recording trial for 4 months, followed by a review. We would then like to run the trial for another 4 months in an additional 4 processors, including a domestic establishment, to ensure the feedback is as inclusive as possible.

Recording Process

We are currently in discussions with an IT company to develop a trial recording program for the pilot studies. The intention is to have the program available on stand-alone tablets for processors that cannot, or do not wish to, record the data with their current plant systems.

Please contact the researchers below for further information.

Regards

Dave Hamilton
Research Veterinarian
0427 164410
David.Hamilton@sa.gov.au

Jessica Jolley (Tan)
Senior Research Scientist
Jessica.Jolley@sa.gov.au

South Australian Research & Development Institute (SARDI)

H4W Presentations delivered to stakeholders

- Due to COVID-19 restrictions, with some exceptions, separate on-line presentations largely replaced face-to-face meetings.
- Individual online presentations on H4W and the collection and reporting of data were delivered by Dr Hamilton to many pig industry stakeholders, including:
    - Darryl D'souza – Sunpork Solutions (Executive General Manager)
    - Bernie Gleeson – Sunpork (pig veterinarian)
    - Kirsty Richards – Sunpork (pig veterinarian)
    - Hugo Dunlop – Chris Richards & Associates (pig veterinarian) plus various producer clients
    - Barrie Lloyd – Barry Lloyd & Associates (pig veterinarian)
    - Cherie Collins & Dr Greg Tuckett – Rivalea (pig veterinarians)
    - Brian Luxford – Rivalea (Technical Manager)
    - Ian Kavanagh – Rivalea (General Manager)
    - Aaron Murphy – Rivalea (Operations Manager)
    - Kim Nairne – Portec Veterinary Services (pig veterinarian)
    - Ross Cutler – Ross Cutler & Associates (pig veterinarian)
    - Regina Fogarty, Sally Salmon & Jaimie Hunnam – Agriculture Victoria (pig veterinarians)
    - Rob Barwell – Animal Health Australia (veterinarian)
    - Verity Sutton & George Waldthausen – Meat and Livestock Australia
    - Jeff Braun – Myora (pig producer)
    - Rob McPherson & Megan Trezona – Linley Valley Pork / Craig Mostyn (General Manager, QA Manager)
    - Patricia Holyoake – Holyoake Veterinary Consulting Pty Ltd (pig veterinarian) and producer client
    - Jorge Chorrez – Craig Mostyn Farms (Senior Piggery Manager)
    - Derk Oorburg – VION Foods, Netherlands (veterinarian, Group QA Manager)
    - Alan Sharock – Lachlan Valley Vets (pig veterinarian) and producer client
    - Rob Patterson & Jon Bartsch – Healthy Herds Pty Ltd (pig veterinarians) plus various producer clients
    - Dale Morris - Pig Services Centre, Chief Veterinary Officer Unity, Bendigo (manager)
    - Jo Ryan & Ben Mason - Frontier Economics
    - Richard Shephard – Herd Health (veterinarian)
    - Des Bowler – Food & Veterinary Services
    - Leah Starick – Agriculture Victoria (pig health veterinarian)
    - Tim Pitman & Yvonne Poon - Exoflare
    - Geoff Benett - Pig Services Centre, Chief Veterinary Unit, Bendigo (manager, Business Services)
    - Megan Scott – Pig Services Centre, Chief Veterinary Officer Unit, Bendigo (veterinarian, Emerging Animal Disease)
    - Dale Pemberton – Coles Pty Ltd (Livestock Manager)
    - Pork Processor Referral Group
    - Libby Tedstone – Livestock SA (Beef & Sheep Industry Blueprint Manager)
- In October 2020, Dave Hamilton attended a meeting of the TOP Group of producers in Mt Gambier and presented on H4W data collection and reporting.

- In March 2021, Dave Hamilton met with Mary Carr (Chief Veterinary Officer SA) and Allison Cawley (PIRSA Veterinary Officer, Biosecurity SA) and presented on H4W.
- SARDI has been in communication with Regina Fogarty and other epidemiological staff at the Department of Victoria, discussing access to de-identified animal health data (carcase and offal) for epidemiological analysis.
- Dave Hamilton was asked to present on H4W and ASF at the 2021 Australian Pig Veterinary conference in September.
- SARDI has provided individual raw H4W farm data to a growing number producers at their request (and the processor's permission) for further analysis by their consultant veterinarians.

Stakeholder Responses to presentations

Below are some excerpts from the feedback from participants following their presentations.

- "The ongoing nature of the data collection to allow trends and patterns to emerge is very useful. Even with vet abattoir checks, these are sporadic or targeted at best and do not collect the range of data proposed in the H4W program."
- "…easily understood, presented as a visual/ graphic result and should stimulate conversation between producer and vet."
- "Thanks again for your time last week – the data that you are collecting will be incredibly useful for us in identifying existing or emerging disease issues on farm. It will provide a benchmark across our farms and the ability to track outcomes from interventions. It is excellent that the data is captured on all animals and not just a subsample from time to time."
- "Overall, very impressed by the outcomes of your project thus far and look forward to being able to utilise the data. I have attached the tattoos for our farms. Could you send through the data that you have on these farms please?"
- "As we discussed last week – there is a lot of pressure from customers (supermarkets in particular) to minimise carcass damage. It is not only damage due to disease but also things like scratch marks if pigs have been mixed prior to sale or in lairage. Having access to data quickly that identifies such issues and the quantitative impact allows us to action appropriate remedies quickly."
- "Extremely useful. The ongoing nature of the data collection to allow trends and patterns to emerge is very useful. Even with vet abattoir checks, these are sporadic or targeted at best and do not collect the range of data proposed in the H4W program. …… Several things like enteric lesions could be flagged before being noticed as an issue on farm – interventions can be made. Seasonal issues like pleurisy can also be tracked to assist with on-farm decisions around interventions…… the sooner this is available at all plants (export plants at least) the better."
- "The data collected on a weekly basis will be extremely useful and complementary to existing PHMS inspection services. Because of the frequency, it will enable us to ID distortions to data collected on PHMS if a hospital pen clean-out occurs the week of the PHMS inspection. It will pick up health changes that can potentially occur in between PHMS inspections."
- "…. we look forward to its adoption across the industry and hopefully being able to utilise this information in the future (as vet and producer)."
- "Thanks for taking the timing to update me on this impressive initiative today. You've certainly given beef and sheep something to aspire to! I look forward to receiving a copy of the PowerPoint when you have a chance."

Letter from stakeholder Healthy Herds

Healthy Herds Pty. Ltd.
ABN: 37 631 492 521

14th October 2021

Feedback to Australian Pork Limited: Use of SARDI~ D. Hamilton Consulting 'Health For Wealth' Real Time Abattoir Health Data in Healthy Herds Pig Veterinary Consulting Practice.

Healthy Herds Pty Ltd (HHs) provides Veterinary Health Consultancy services to Client herds with a total breeding herd population of 12,000 sows. Client herds are located in SA and NSW, with processing of pigs from the herds carried out at SA, Victorian & NSW abattoirs.

On 6th October 2020 David Hamilton presented the capabilities and potential of 'Health for Wealth' (HFW) Real Time Abattoir Health Monitoring to a Prominent Farm Alliance group that includes a number of our clients.

Healthy Herds immediately recognised the potential for this data to link to Batch Close-Out treatment, mortality, production and housing sensor data we are increasingly collecting and managing on our client herds.

Over the course of the past 12 months we have worked with David to access Health for Wealth abattoir data for two of our medium clients (400 – 600 sows) and two of our large clients (2000 – 4000 sows) in order to investigate the way we can utilise and integrate this data to provide maximum value for our clients.

A/ Use of HFW Data in decision making to help guide Antimicrobial Use reduction strategies through targeting more timely intervention on farm:

a) The Health for Wealth Data has potential to be a valuable cross-check against on-farm clinical sign, mortality and treatment data from each batch of pigs sold.

For example increased on-farm Wean to finish Group Cough Scores were correlated with increased HFW pleurisy scores in one of the medium sized herd participating in our pilot trial.

b) The frequency of normal PHMS inspections on this farm had been impacted by COVID restrictions and HFW data enabled us to schedule some targeted PHMS inspections.

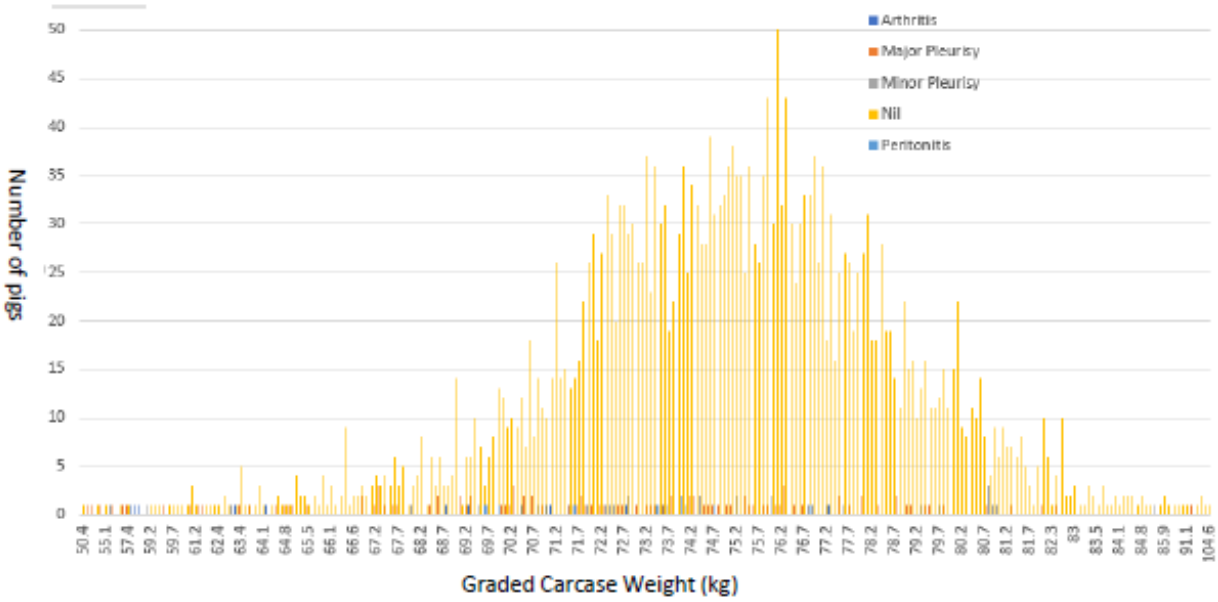
c) An intervention of a period of an additional (2nd) vaccination against *Mycoplasma hyopnemoniae* was instituted in this herd and quickly reduced on farm coughing, growth depression and individual antibiotic treatments

Email: Vets@Healthyherds.com.au 26 Fifth Street, BOWDEN, South Australia 5007 Ph 0409 444 405

B/ Use of raw HFW Data

Healthy Herds sees the potential for use of raw HFW data. For example, distribution of carcase metrics (graded weight, graded fat) with lesion data can be used to estimate payback of future of targeted health actions such as vaccinations or 'herd closure' disease eradications on farm.

As an example, the chart below of a farm's kill data for a period shows pleurisy and arthritis / polyserositis conditions tending to occur in lighter carcase weight pigs.



C/ Future opportunities for our Consultancy as Health for Wealth becomes mainstream

As data acquisition and analytics becomes a mainstream part of industry decision making, Healthy Herds has invested heavily in new App and data systems and sensors to enable seamless transfer of data from shed to farm management and on to health and production advisers.

We are excited that David Hamilton Consulting is working through the HFW program to bring the best of systems that can bring real time batch by batch data to producers and in turn to their veterinarians. David has long experience in the rigor needed to work with processors to develop systems such as that implemented by Vion Pork processing facilities in the Netherlands.

Dr Jon Bartsch BSc, DVM, MANZCVS (Pig Health and Production), Dr Rob Paterson BSc (Hons) BVMS

Consulting Veterinarians

Health Herds Pty Ltd

14/10/21

9. Appendix 2: H4W data entry touch screen setup at Diamond Valley Pork, Seven Point Pork, Swickers and the stand-alone tablets

Figures 4, 5 and 6 below show the input button categories and arrangement developed by SARDI and Marel for the H4W stand-alone tablet trial system.

Figure 4: H4W primary carcase inspection touch screen template for stand-alone tablets.

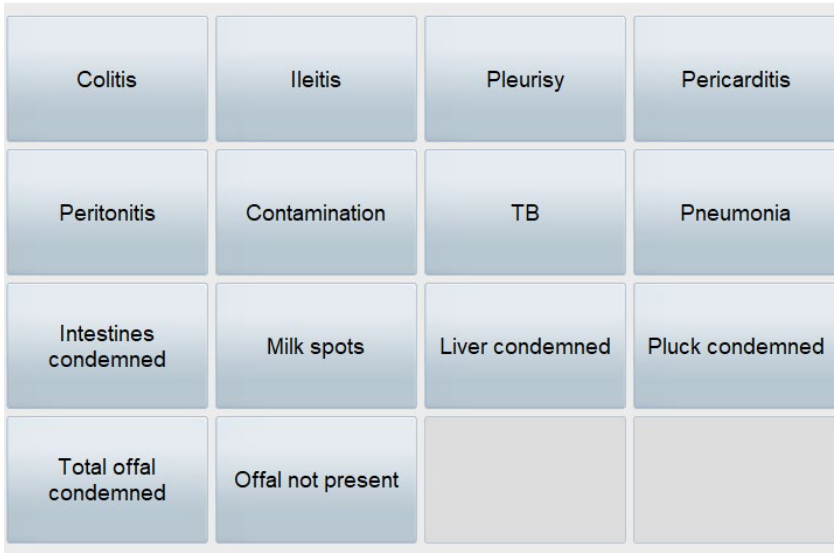


Figure 5: H4W viscera inspection touch screen template for stand-alone tablets.
The screen is touched twice to enter the condition and then the associated consequence/intervention.

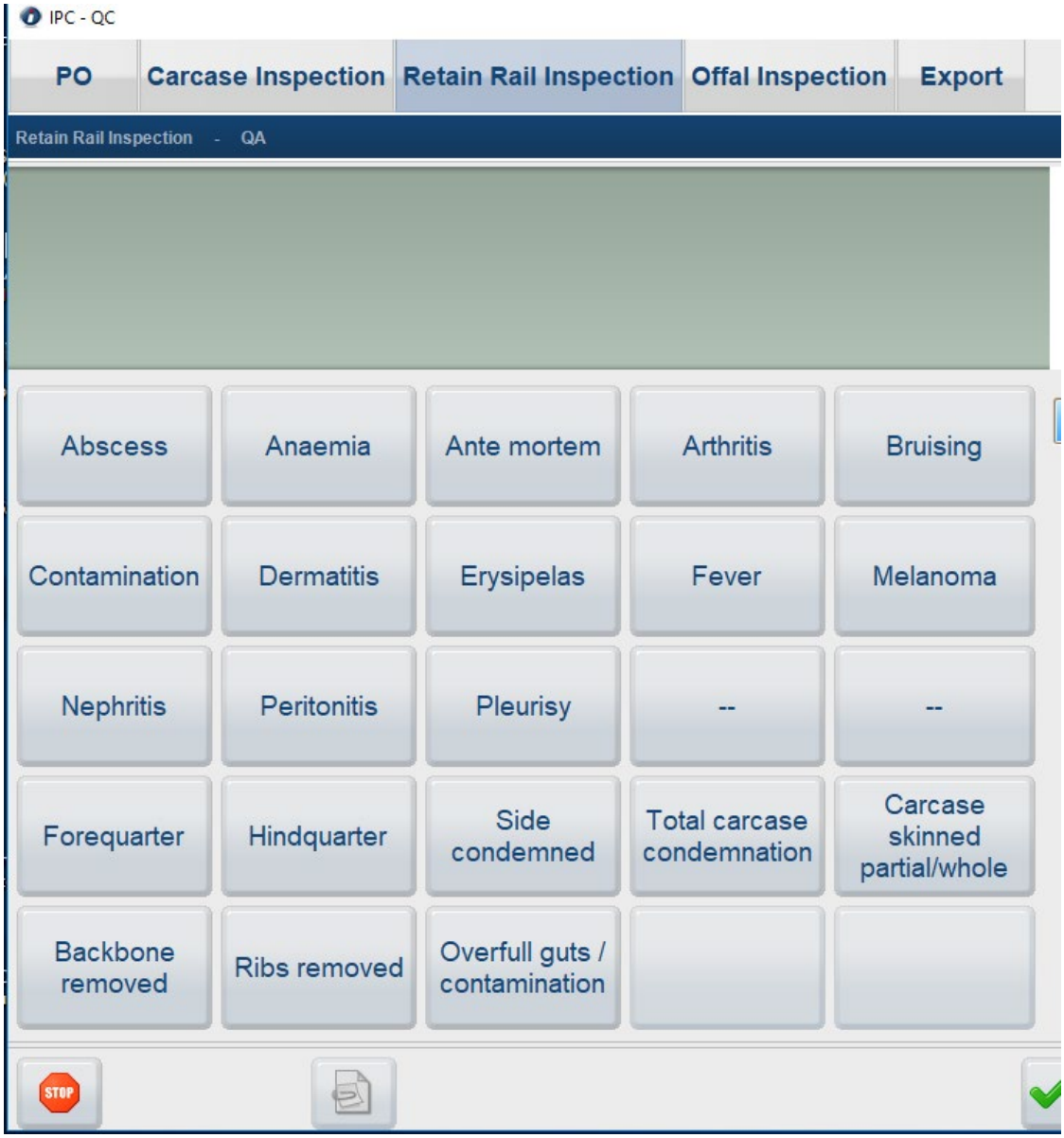


Figure 6: H4W retain rail inspection touch screen template for stand-alone tablets.

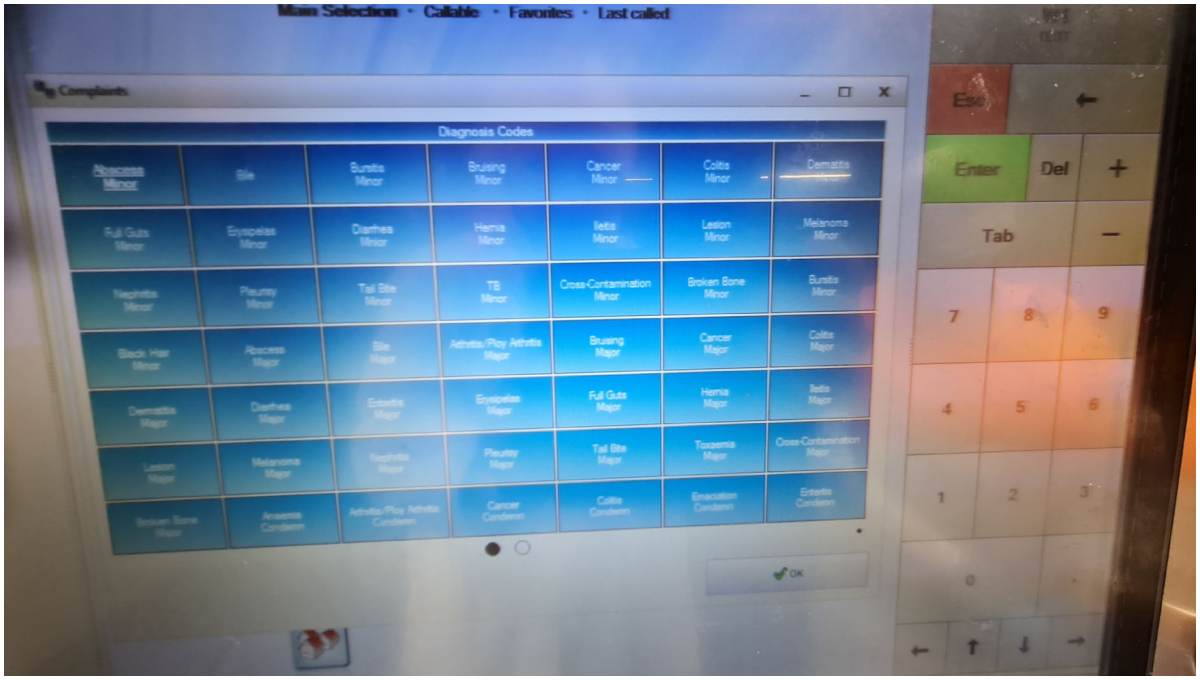
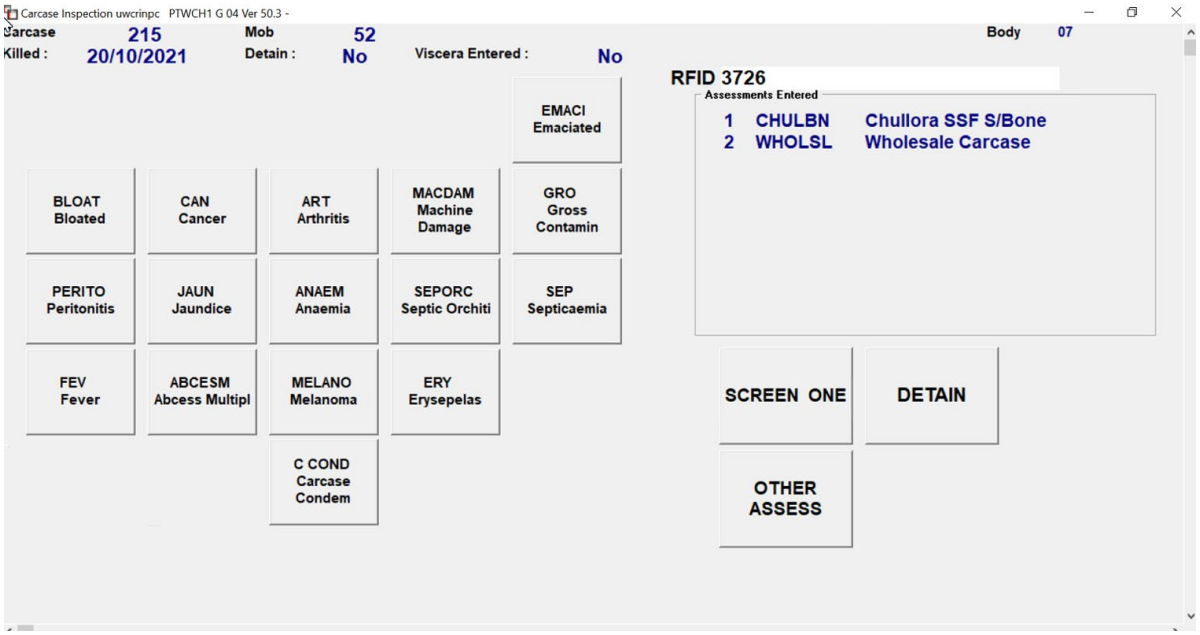


Figure 7: A screen shot of the carcase inspection data input screen at DVP.
There are many more choices than on the stand-alone tablet template, but they can be adjusted into, and reported under, the broader H4W categories.

Below are four screen shots from the SPP retain rail data entry terminal, showing data entry options for carcase 215 (RFID 3726). The entered data is uploaded daily to SARDI for processing and entry into the H4W database. Although the appearance is different to DVP, the data is adjusted into comparable H4W categories.



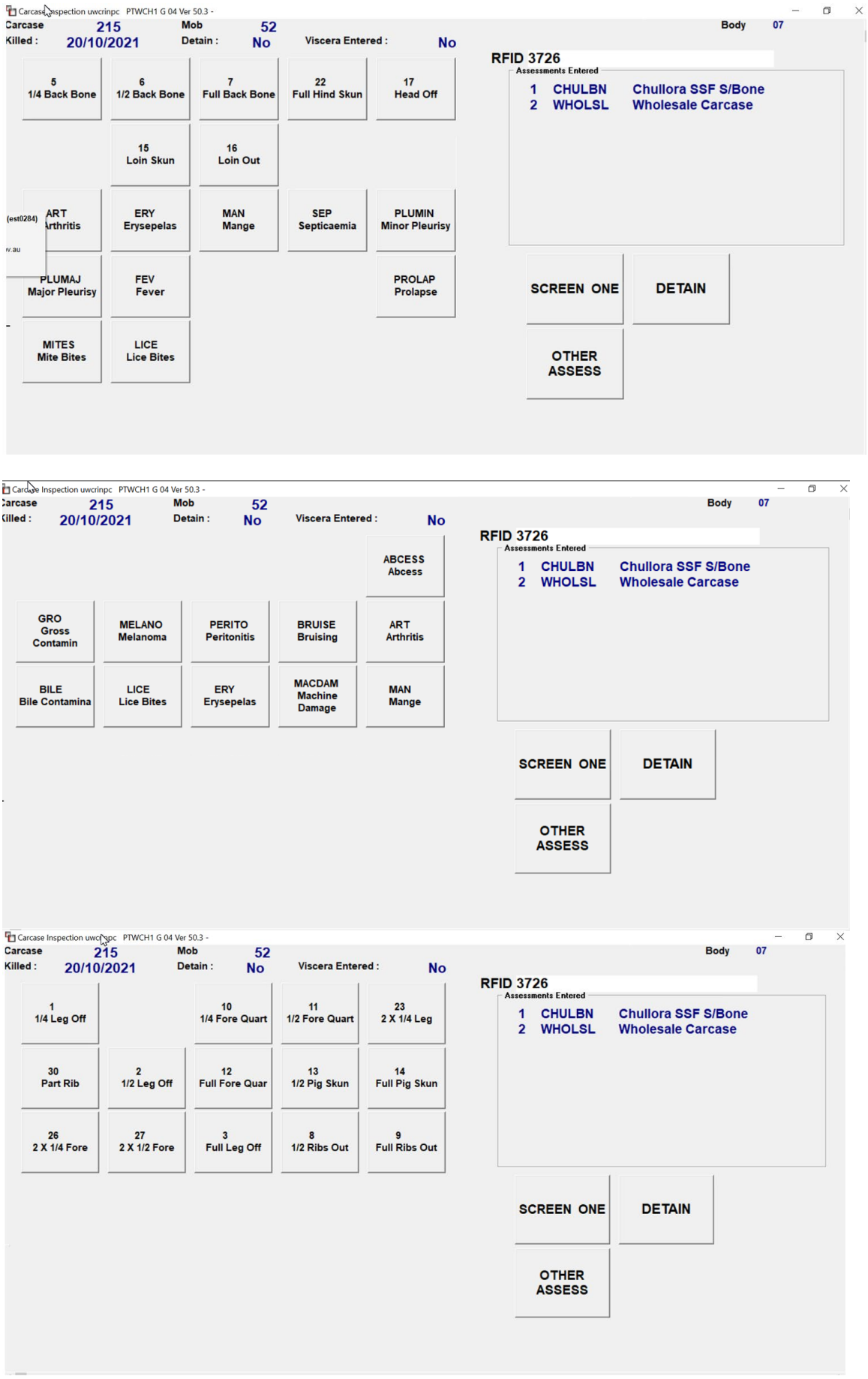


Figure 8: Screen shots from the SPP retain rail data entry terminal.

Figure 9: A screen shot of the carcase inspection data input screen at Swickers.
Once again, the flexibility of the H4W system allows the plant data to be adjusted into comparable H4W categories.

Appendix 3: Example reports

1 Abscess

Table 2: Weekly prevalence of abscesses for different tattoos. Average % represents the average of the weekly prevalences for an individual tattoo since May 2019.

Week	Tattoo	Pigs Killed	No.	%	Average %
26	Tattoo 1	697	4	0.6	0.8
26	Tattoo 2	299	2	0.7	0.5
26	Tattoo 3	140	3	2.1	2.1
26	Tattoo 4	150	0	0.0	0.8
26	Tattoo 5	300	2	0.7	0.3
26	Tattoo 6	370	18	4.9	4.8
26	Tattoo 7	4	0	0.0	0.0
26	Tattoo 8	143	1	0.7	1.7
26	Tattoo 9	35	0	0.0	0.9
26	Tattoo 10	56	0	0.0	0.5
26	Tattoo 11	27	0	0.0	0.0
26	Tattoo 12	39	0	0.0	0.5
26	Tattoo 13	141	3	2.1	1.7
26	Tattoo 14	53	0	0.0	0.2
26	Tattoo 15	8	0	0.0	0.0
26	Tattoo 16	142	1	0.7	0.6
26	Tattoo 17	4	0	0.0	0.0
26	Tattoo 18	180	1	0.6	0.9
26	Tattoo 19	160	0	0.0	0.6
26	Tattoo 20	149	2	1.3	1.7
26	Tattoo 21	20	0	0.0	0.3
26	Tattoo 22	100	1	1.0	0.4
26	Tattoo 23	30	1	3.3	0.9
26	Tattoo 24	17	0	0.0	0.2
26	Tattoo 25	10	0	0.0	7.0
26	Tattoo 26	711	7	1.0	1.2
26	Tattoo 27	65	0	0.0	0.9
26	Tattoo 28	28	0	0.0	0.0
26	Tattoo 29	17	3	17.6	5.5
26	Tattoo 30	20	0	0.0	1.2

Table 4: Example of a data printout of the H4W database for week 26, category Abscess.
Tattoo numbers have been removed to protect confidentiality. Typically, one week of inspection data from a single abattoir could produce over 250 pages of tables like this, necessitating the development of an approachable summary template (see figures below).

Figure 10: Example of a one-page processor H4W summary report for carcase inspection data, covering the period from week 37 to week 07 (23 weeks).
The graphs depict the average weekly prevalences for the eleven agreed H4W carcase defect categories for each of the three plants. It allows the processor to benchmark anonymously against other plants. Unusually large variations can then be discreetly investigated to ascertain if the differences are due to variability in recording errors, inspection inconsistency or pig health status. This ability to anonymously benchmark is seen as being of value by processors. It is intended that all participating plants be included on these regular reports.

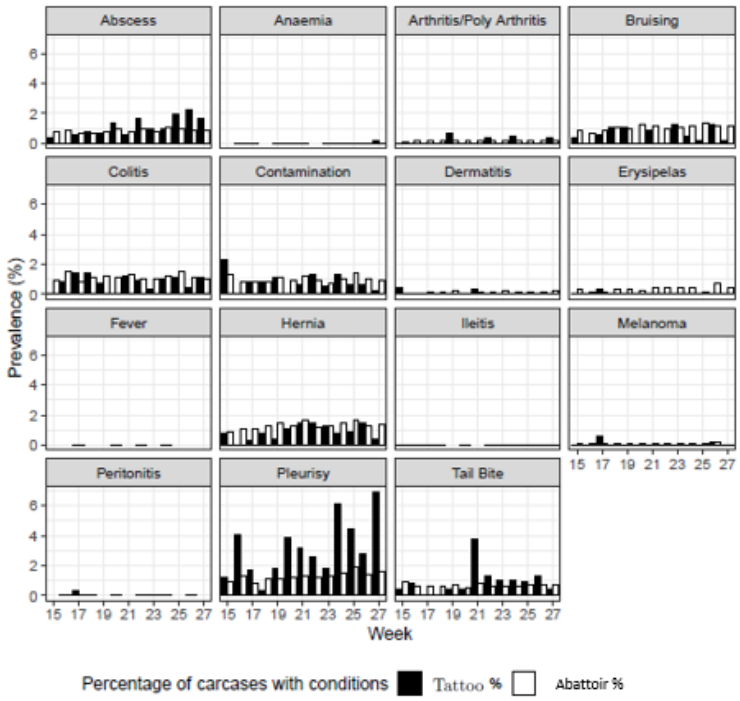


Table 139: Number of pigs killed per week

Week	Pigs Killed
15	260
16	121
17	360
18	360
19	280
20	280
21	340
22	462
23	396
24	392
25	467
26	465
27	465

Table 140: Number of carcases with parts removed or condemned (partial or whole) for this week

Week	Pigs Killed	Condition	FQ/HQ	Leg	Backbone	Ribs	Side	Carcase skinned
27	465	Abscess	1	0	0	3	0	0
27	465	Arthritis/Poly Arthritis	1	1	0	0	0	0
27	465	Bruising	1	0	0	0	0	0
27	465	Pleurisy	7	1	0	2	0	0

Figure 11: Example Farm A, page 1of two-page producer H4W summary report for carcase inspection data, covering the period from week 15 to week 27 (13 weeks).
The black columns depict the average weekly prevalence for the eleven agreed H4W carcase defect categories for this tattoo. The adjacent white columns depict the average prevalence for all other pigs killed at the same plant in the same week. This allows the producer to benchmark anonymously against peers. To provide context, Table 139 in the figure lists the number of pigs that the producer sent for slaughter in each of the weeks. Table 140 in the figure lists the consequences/interventions/partial condemnations associated with the carcase inspection defects graphed in week 27, the latest week in the report.

Note that the tail bite category was added at the request of the processor, reflecting their particular interest in monitoring this condition. The Marel software is flexible and can easily include additional categories of interest.

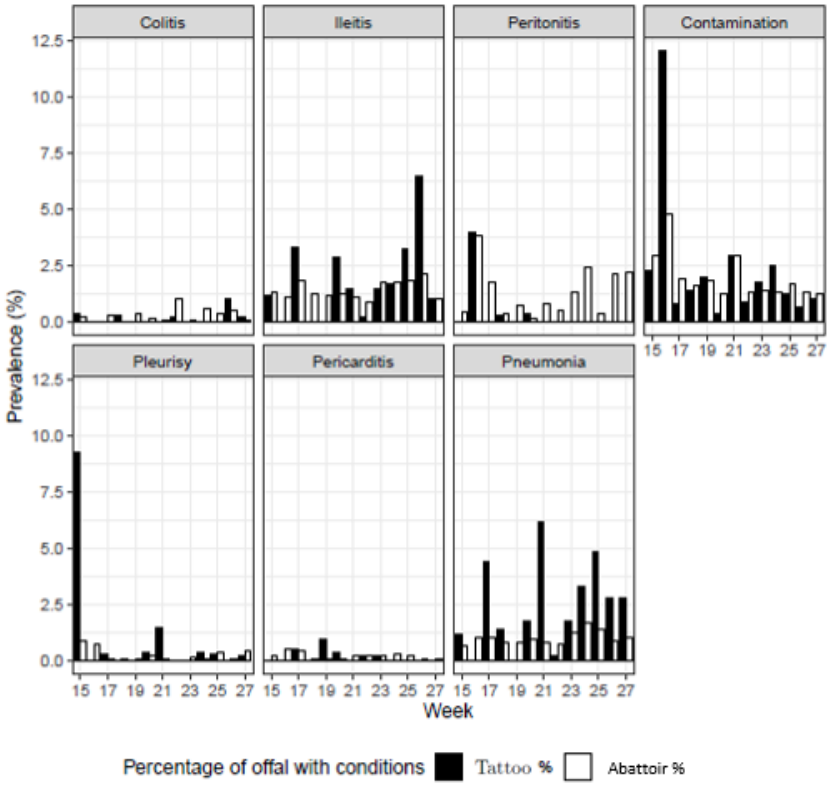
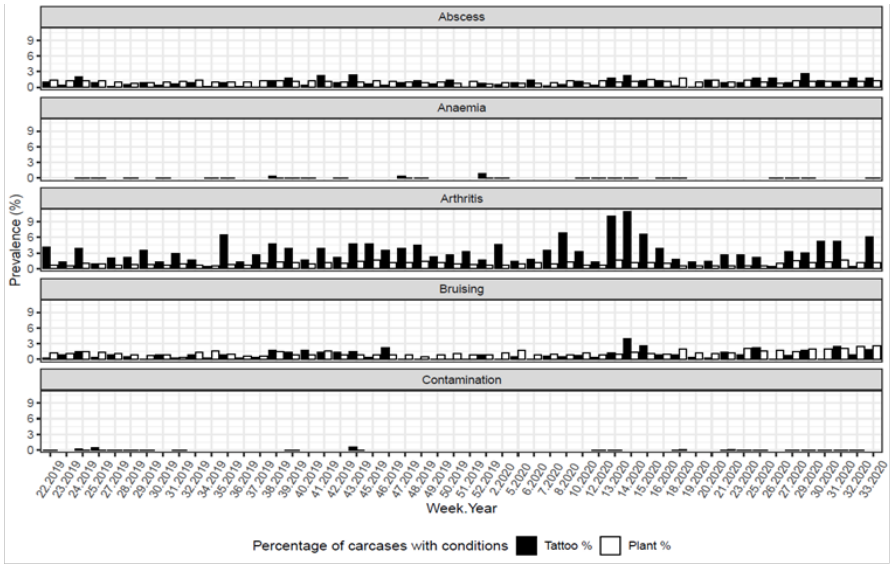
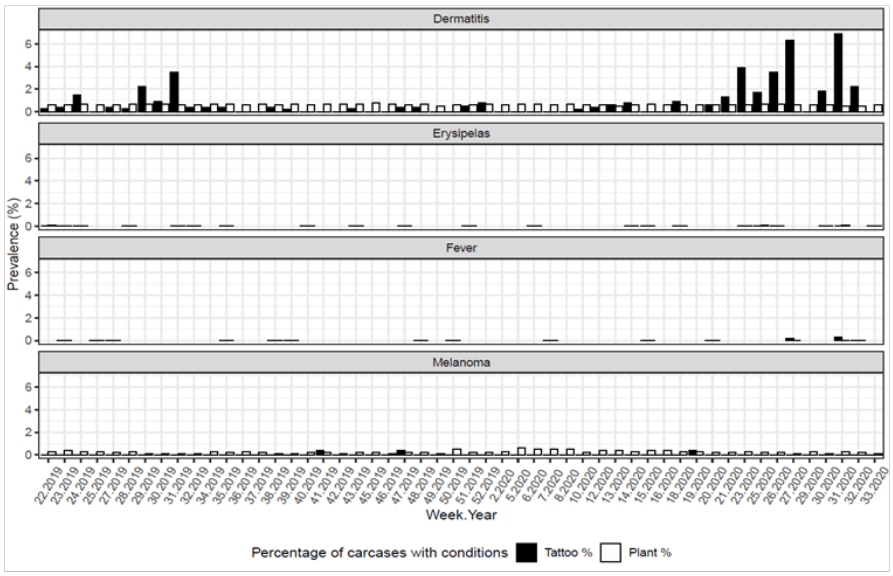


Table 142: Number of offal with parts removed or condemned (partial or whole) for this week

Week	Condition	Number of Offal
27	Pluck.condemned	17
27	Offal.not.present	18
27	Ileitis	5
27	Pericarditis	0
27	Intestines.condemned	9
27	Liver.condemned	9
27	TB	0
27	Colitis	1
27	Total.offal.condemned	6
27	Contamination	5
27	Nephritis	7
27	Pneumonia	13
27	Peritonitis	0
27	Pleurisy	1

Figure 12: Example Farm A, page 2 of a two-page producer H4W summary report for viscera inspection data, covering the period from week 15 to week 27 (13 weeks).
The black columns depict the average weekly prevalences for the seven agreed H4W viscera defect categories for this tattoo. The adjacent white column depict the average prevalence for all other pigs killed at the same plant in the same week. This allows the producer to benchmark anonymously against peers. To highlight losses, Table 132 in the figure lists the offal condemnations associated with the viscera inspection defects graphed in week 27, the latest week in the report.





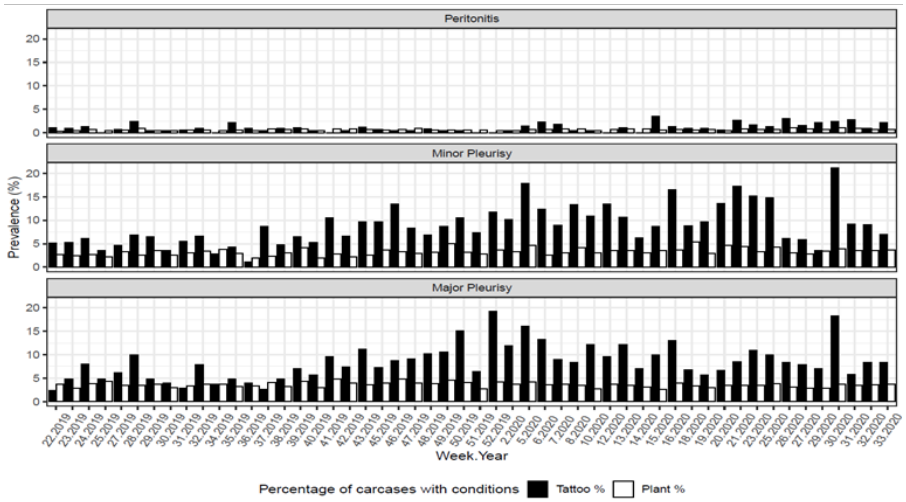


Figure 13: Example of an extended producer H4W summary report for carcase inspection data, covering the period from week 22/2019 to week 33/2020 (63 weeks).
Once again, the black columns depict the average weekly prevalences for the eleven agreed H4W carcase defect categories for this tattoo. The adjacent white column depict the average prevalence for all other pigs killed at the same plant in the same week.

These graphs, which depict the same data as the 3-monthly reports but over a longer timeline, allow the producer and veterinarian to more readily identify trends and seasonal changes, as well as any response to on-farm interventions.

10. Literature cited

Hamilton, D., Holds, G., Kiermeier, A., Pointon, A., and Tan, J. (2014). Uptake of Food Safety Research.
APL Project 2012/2400.

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Hudson, D., and Hamilton, D. (2016). Assessing the economic and operational impact of establishing a national 'real time' slaughter chain reporting scheme for pig producers, processors and industry regulators. APL Project 2015/2209.

Jolley, J., Pointon, A., and Hamilton, D. (2018). Development of standards for ante/post-mortem processor data collection and reporting for the pork industry. APL Project 2017/004.

11. Publications Arising

Not applicable