Movement of disease conveyors between New Zealand pig farms: frequency and distance patterns

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Introduction

A study was conducted with the aim of identifying movement patterns of disease conveyors in the New Zealand pork industry. The extent of interactivity between farms in commercial, para-commercial, and non-commercial sectors was evaluated.

Principal objectives were:

Objective 1: Identify the movement patterns of potentially important disease conveyors amongst pig holdings in New Zealand; and

Objective 2: Determine the social network structure within and between the commercial, para-commercial, and non-commercial pig sectors of the New Zealand pork industry.

Methodology

The study was carried out in three phases, involving a combination of postal questionnaires and telephone interviews. Existing databases held by NZ PORK and AsureQuality Ltd (AgriBase) were used as base data to generate the study sample frame.

**Phase 1 – Postal Questionnaire Study**

The first phase of the study was a postal questionnaire mail out comprising an AgriBase update form (to update/capture basic farm profile information) and a supplementary questionnaire designed to capture specific information directly related to the objectives of the study. The questions included coverage of the following areas of interest:

- All major disease conveyors known to be involved in the transmission of Foot and Mouth Disease and Classical Swine Fever;
- Type and number of conveyors involved (pigs, semen, feed, effluent, people, trucks and others);
- Frequency and distances for movement occurrences;
- Direction of movement (away from the farm, toward the farm, between farms); and
- Miscellaneous other relevant characteristics.
Data from the completed postal questionnaires were entered into a database format by AsureQuality staff. The data from the AgriBase update form were entered into AgriBase and the supplementary information specific to this study were entered into a separate relational database developed specifically for the project. The database was constructed in SQL-Server, and the data-entry forms were designed and implemented as Web forms using Cold Fusion. When data entry was completed, data from both databases were extracted and merged into a combined Microsoft Access dataset that was provided to Massey University for quantitative analysis.

**Phase II – In-depth Telephone Interviews**

For the second phase of the study, data from the postal questionnaires were stratified into three sector groups (commercial, para-commercial and non-commercial) and 20 in-depth telephone interviews were conducted per sector on a random sampling basis. The purpose of these interviews was to provide context to the quantitative data collected in the first phase of the study and to understand better the social and relational networks operating within and between the three identified sectors of the pig industry.

**Phase III – Regionally-based Farm Service Provider Study**

In order to cross-validate information gained from pig owners in the earlier parts of the study and to explore further the network of off-farm interactions, a regional service-provider based study was undertaken as the final phase of data collection.

This study was designed to collect detailed information on the nature and quantity of pig farmer/ owner interactions with other pig farmers/ owners, industry vendors, feed suppliers and other social contacts. Through consultation with MAF, central Canterbury (bounded roughly by the Waimakariri River on the north and the Rakaia River on the south) was chosen as the specific focus region for this work.

A list of farm service providers operating in the area was collated from various industry sources and a standardised data capture form developed. Respondents were contacted by telephone to obtain the data required.

**Findings**

**Response Rates**

The commercial sector questionnaire was posted to a total of 275 pork producers registered with NZ PORK and of these, 127 were returned. This equated to an overall response rate of 46.2% thus meeting the 40% minimum desired response rate. Out of the 127 surveys that were returned, 114 respondents (90.6%) reported currently having pigs on their premises.
The non-commercial/ para-commercial survey was mailed to 6980 farms that were identified as owning pigs and of these, 1814 (26.0%) responded to the survey. This exceeded the 20% minimum desired response rate for this sector. 1363 of the 1814 (75.1%) that responded reported they still owned pigs and were included in the final dataset for analysis. All respondents not owning pigs were purged from the dataset and analysed separately. In total, 1477 records were obtained for quantitative analysis.

**Representativeness and Data Reliability**

The responses obtained were geographically representative of the known distribution of the New Zealand pork industry. In terms of demographic representation there is little or no existing reliable demographic data with which to compare the survey results. Detailed commentary on data reliability is presented in the full report.

**Key Risk Conveyors**

Key disease risk conveyors identified were:

- Pigs and other livestock;
- Semen;
- Vehicles;
- Household/ kitchen waste; and
- People

**InterSpreadPlus Parameters**

An important outcome of the current work has been the development of seven farm type definitions suitable for use in ISP. These farm type definitions captured elements of pig inventory (and phase of production), their risk of transmitting disease onward to another farm (their “movement off” profile), and their stability over time (ie – were they highly motivated to be in the business, or more likely to go in/out as conditions changed?).

Movement frequency and distance parameters were calculated for movements of potential disease conveyors on/ off and between the seven ISP farm types.

Importantly, this study was able to generate information from an adequate number of farms (n=1477) such that estimates of disease conveyor movement frequencies and distances will be per farm valid.

These estimates have been supplied to MAF so that additional analyses may be done to support current and future disease modelling efforts.

**Social Network Analysis**
Whilst extensive information was obtained in this study to describe the general patterns of movement of pigs and disease risk conveyors in the NZ pork industry and also related risk behaviours, detailed social network diagrams were unable to be constructed as that would have required a level of precision in the data that was not available.

Conclusions
The major conclusions of this study are as follows:

- Risk factors for disease introduction and transmission vary by farm enterprise type;
- Farm staff and feed (notably kitchen waste on less commercial farm types) appear to be the most common potential disease conveyors arriving onto NZ pig farms;
- For specific farm types (particularly larger commercial farms with breeding sows), introduction of germplasm through semen or live breeding stock was also a frequent occurrence and for others, weaner pigs coming onto the property was a potential source of disease introduction;
- People (staff and visitors, travelling both to homes and saleyards), abattoir-destined pigs, and cattle movements are frequent events in terms of movements off farms where there are pigs;
- Vehicle movements potentially are a major risk factor for disease transfer between farms (although it is important to note that most of the vehicle movements on and off farms in this study were not to/ from another farm);
- It is common for stock both on and off properties to travel long distances from point to point.

Combined with the relatively low density of pig farms in many areas of New Zealand, this suggests that an exotic disease in the pork industry may appear as resulting from a multipoint source introduction of an agent, when in fact it could have as likely been caused by a single introduction, but spread rapidly over long distances through movement of livestock or other vectors.

- Interaction between the three main farm types (commercial, para-commercial and non-commercial) appears limited.
- Proportionately, the para-commercial sector has more movements of store/ weaner pigs and more pigs kept outdoors than the other two sectors as well as fewer movements of pigs direct to abattoirs for slaughter. The practices in this sector may warrant future study to evaluate the relative risks arising from their more extensive use of outdoor facilities.
- Saleyards are used more by the non-commercial and para-commercial sectors. However, the use of saleyards, even by these sectors, appears to be an infrequent
event. Relatively, not many pigs go through the saleyard with most movements of pigs instead being direct from farm to farm.

- 80% of stock moved off farms in the commercial/ non-commercial sectors go to abattoirs, as do 70% of stock moved off para-commercial properties. Abattoir movements need more study. Even if the per-event risk is small, the frequency and distances make the ultimate risk of disease transmission a concern. Abattoirs are certainly important as surveillance points in this sector.

- Other cloven-hoofed livestock are common on New Zealand farms that also have pigs, making interspecies disease transfer a realistic possibility.

- Staff are the most frequent movements on/off many farms. We don’t know if they really contribute much individual risk (how long does a pig pathogen last on your hair, your tonsils, your boots, etc?) but in sum, they are responsible for a lot of on/off movement.