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Description of the pig production systems, biosecurity practices and herd health providers in two provinces with high swine density in the Philippines

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ABSTRACT

A cross-sectional study was conducted between October 2011 and March 2012 in two major pig producing provinces in the Philippines. Four hundred and seventy one pig farms slaughtering finisher pigs at government operated abattoirs participated in this study. The objectives of this study were to group: (a) smallholder (*S*) and commercial (*C*) production systems into patterns according to their herd health providers (HHPs), and obtain descriptive information about the grouped *S* and *C* production systems; and (b) identify key HHPs within each production system using social network analysis. On-farm veterinarians, private consultants, pharmaceutical company representatives, government veterinarians, livestock and agricultural technicians, and agricultural supply stores were found to be actively interacting with pig farmers. Four clusters were identified based on production system and their choice of HHPs. Differences in management and biosecurity practices were found between *S* and *C* clusters. Private HHPs provided a service to larger *C* and some larger *S* farms, and have little or no interaction with the other HHPs. Government HHPs provided herd health service mainly to *S* farms and small *C* farms. Agricultural supply stores were identified as a dominant solitary HHP and provided herd health services to the majority of farmers. Increased knowledge of the routine management and biosecurity practices of *S* and *C* farmers and the key HHPs that are likely to be associated with those practices would be of value as this information could be used to inform a risk-based approach to disease surveillance and control.

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1. Introduction

The Philippine swine population was estimated at around 1.6 million (M) sows with a total of 12.2 M pigs (BAS, 2011). The majority of the pig population is on the islands of Luzon (47%; 5.7 M) and Mindanao (29%; 3.5 M). A key feature of the Philippine pig industry is the smallholder production system (termed smallholder farms). Smallholder farmers (*S*), as defined by the Philippines Bureau of Agricultural Statistics (BAS) and used for the purpose of this study, were farmers raising one to 41 pigs (young or adult) in their backyards per year (BAS, 2011). Approximately 70% (8.5 M) of the total pig population is found on S

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farms (BAS, 2011), and pigs raised are often used for their own consumption or as financial security (More et al., 1999; Lanada et al., 2005; Lee et al., 2005). Commercial farms (*C*) as defined by BAS and used for the purpose of this study are farms which satisfy at least one of the following conditions (BAS, 2011): (1) at least 21 head of adult pigs; (2) at least 41 head of grower pigs; or (3) at least 10 head of adults and 22 head of grower pigs. The commercial production system represents 30% of the Philippine pig industry.

Smallholder and *C* farms almost exclusively supply pork to the local fresh meat markets indirectly through livestock traders (Bantugan et al., 1992; More et al., 1999). On a daily basis, livestock traders source their pigs from multiple farms. The daily activity of livestock traders is mainly driven by fresh meat market demands.

The structure of the pig industry in the Philippines is likely to increase the frequency of contact (direct and indirect) between herds (Hurnik et al., 1994; Stark, 2000; Ribbens et al., 2009). This increased frequency of contact increases the likelihood and severity of introducing respiratory disease agents irrespective of production type (Gardner et al., 2002; Otake et al., 2010; Lambert et al., 2012b). The consequences of disease introduction were manifested in the porcine reproductive and respiratory syndrome (PRRS) and porcine circovirus type 2 (PCV2) outbreaks in 2008 (Resontoc, 2009). Both *S* and *C* farms reported increased mortality in their herds and this resulted in substantial financial and domestic trade implications for the Philippine swine industry (Resontoc, 2009; BAS, 2011). With the silent circulation of infectious agents like PCV2 and PRRS virus, the challenge for regulatory veterinary authorities, farm management and their herd health providers (HHP) is to ensure that sufficient measures (e.g. biosecurity, housing, vaccination, transport, market access) are always in place to reduce the risk of disease introduction into herds (Amass and Clark, 1999; Gardner et al., 2002; Lambert et al., 2012b). There is a paucity of information about farm management, animal husbandry and biosecurity practices of the *S* and *C* production systems in the Philippines. Knowledge of 'weak points' or areas of 'vulnerability' of production systems ('vulnerability' can be a subjective assessment of certain management practices such as biosecurity) where infectious pathogens might enter the herd and establish is important because it provides a better focus for disease control and surveillance activities.

Filipino pig farmers have access to several HHPs that range in training and experience from agricultural supply store personnel to private swine veterinary consultants. It is plausible to assume that the effectiveness of farm management practices to reduce the risk of disease introduction (or maintenance) in the herd is influenced by farm choice of HHP. Therefore, in a developing country such as the Philippines where financial resources are limited, a better understanding of farm and HHP network dynamics has the potential to form the basis of a risk-based surveillance or disease control programme. Local veterinary authorities could identify 'vulnerable' farms and their HHP(s) through routine field investigations. The authorities could then preferentially communicate with HHP(s) of 'vulnerable' farms to improve the management practices of the identified HHPs' entire client network rather than focusing on individual farms.

Social network analysis (SNA; Wasserman and Faust, 1994) offers a means for formalising the process of identifying 'vulnerable' farms and their HHPs. Social network analysis provides a network-based approach to reveal the structure of the relationships between farm and HHP (Dube et al., 2009), and to quantify those relationships within the network (Wasserman and Faust, 1994). The use of SNA in animal populations is increasing (Christley and French, 2003; Christley et al., 2005; Martin et al., 2011), and reviews are provided by Newman (2003) and Dube et al. (2009).

The objectives of this study were to: (a) group *S* and *C* production systems into patterns according to their HHP(s); (b) obtain descriptive information about the grouped *S* and *C* production systems in two provinces of high swine density in the Philippines; and (c) identify key HHPs within each production system using SNA. Increased knowledge of the characteristics of *S* and *C* farms (e.g. farm type, size, and biosecurity practices) and the key HHPs that are likely to be associated with or influence those characteristics would be of value as this information could be used to inform a risk-based approach to disease surveillance and control.

2. Materials and methods

2.1. Study design and source population

A cross-sectional study was conducted between October 2011 and March 2012 in two major pig producing provinces (Bulacan and Pampanga) in Region 3 (Central Luzon). Region 3 was selected because it is one of the most intensive pig rearing regions in the Philippines (BAS, 2011), and has reported major outbreaks and losses from acute respiratory disease in pigs in 2008 PRRS and PCV2 outbreaks (Resontoc, 2009). This study is part of a large abattoir based cross-sectional study that aimed to estimate prevalence and risk factors associated with respiratory disease lesions in finisher pigs at slaughter. Therefore, the target population was pig farms producing finisher pigs in Bulacan and Pampanga provinces. The source population was farms slaughtering finisher pigs on randomly selected calendar dates at government operated abattoirs ($n = 29$) in Bulacan and Pampanga provinces. Because a complete list comprising source and number of slaughtered finisher pigs was not available prior to slaughter time, systematic random sampling was used at the time of slaughter to select the study population (farms of origin).

2.2. Farm enrolment process

Field staff of the Provincial Veterinary Office (PVO) asked meat inspectors at participating slaughterhouses and livestock traders in Bulacan and Pampanga provinces to record the following information at the time that finisher pigs arrived for slaughter: (1) date of slaughter; (2) livestock trader name, address and contact details; (3) livestock transporter name, address and contact details; (4) name and address of the pig farm from which pigs were purchased; (5) date of purchase; and (6) number of pigs

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