Preventive Veterinary Medicine 109 (2013) 58–68

Contents lists available at SciVerse ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Evaluation of external biosecurity practices on southern Ontario sow farms

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ARTICLE INFO

Article history:
Received 9 March 2012
Received in revised form 20 August 2012
Accepted 22 August 2012

Keywords:
Swine
Biosecurity
Cluster analysis
Spatial analysis
Multinomial logistic regression

ABSTRACT

External biosecurity protocols, aimed at preventing the introduction of new pathogens to the farm environment, are becoming increasingly important in the swine industry. Although assessments at the individual farm level occur regularly, efforts to cluster swine herds into meaningful biosecurity groups and to summarize this information at the regional level are relatively infrequent. The objectives of this study were: (i) to summarize external biosecurity practices on sow farms in southern Ontario; (ii) to cluster these farms into discrete biosecurity groups and to describe their characteristics, the variables of importance in differentiating between these groups, and their geographic distribution; and (iii) to identify significant predictors of biosecurity group membership. Data were collected using the Production Animal Disease Risk Assessment Program's Survey for the Breeding Herd. A subset of variables pertaining to external biosecurity practices was selected for two-step cluster analysis, which resulted in 3 discrete biosecurity groups. These groups were named by the authors as: (i) high biosecurity herds that were open with respect to replacement animals, (ii) high biosecurity herds that were closed with respect to replacement animals, and (iii) low biosecurity herds. Variables pertaining to trucking practices and the source of replacement animals were the most important in differentiating between these groups. Multinomial logistic regression provided insight into which demographic and neighborhood variables serve as significant predictors of biosecurity group membership ($p < 0.05$). Variables in the final regression model include: herd density within a 4.8 km radius, number of sows on the premises, and site production type. The odds of belonging to the high biosecurity group that was open with respect to replacement animals, relative to the low biosecurity group, increased 1.001 times for each additional sow ($p = 0.001$). The odds of belonging to the high biosecurity group that was open with respect to replacement animals, relative to the low biosecurity group, were 6.5 times greater for farms that produced genetic animals than for farms that produced commercial animals ($p = 0.003$). The information obtained through this work allows a better understanding of biosecurity in sow herds at the regional level, and the implementation of biosecurity protocols in North American swine herds in general.

1. Introduction

Biosecurity is defined as "the implementation of measures that reduce the risk of the introduction and spread of disease agents; it requires the adoption of a set of

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http://dx.doi.org/10.1016/j.prevetmed.2012.08.013

attitudes and behaviors by people to reduce the risk in all activities involving domestic, captive/exotic and wild animals and their products" (FAO, 2010). These principles are especially important in the North American swine industry where a large-scale, industrialized model means that the potential impact of disease introduction and spread can be devastating (FAO, 2010). Biosecurity as a general concept can be subdivided into 3 categories: bio-exclusion, bio-management, and bio-containment (CSHB, 2010). Bio-exclusion, also known as external biosecurity, is defined by the Canadian Swine Health Board as those biosecurity protocols aimed at preventing the introduction of new pathogens to the farm environment. These types of practices are an important indicator for the risk of pathogen incursion, especially in regards to the porcine reproductive and respiratory syndrome (PRRS) virus (Holtkamp et al., 2010; Lambert et al., 2012). Once a pathogen is present on-farm, bio-management protocols prevent or limit pathogen persistence and spread within the farm. Bio-containment procedures are aimed at preventing the escape and spread of pathogens to other swine sites (CSHB, 2010).

Although it is impossible to achieve zero risk in the farm environment (Pritchard et al., 2005; Graham et al., 2008), biosecurity practices aid in reducing that risk. One recent study utilized the PRRS Risk Assessment for the Breeding Herd (version 1) to examine how long PRRSV-free herds were able to maintain freedom from the disease (Holtkamp et al., 2010). The authors found that herds with a high score on the external risks section were at greater risk for becoming PRRSV-positive and had shorter virus-free intervals (Holtkamp et al., 2010). This important finding confirms that external biosecurity practices are essential in the prevention of viral pathogen introduction. Such practices can reduce production losses, aid in the control of geographic spread, and are beneficial from an animal welfare standpoint. The majority of farms tend to focus on external biosecurity measures and allocate a large proportion of resources for this purpose (Otte et al., 2007).

Given the importance of external biosecurity, it is advantageous to evaluate how well producers are meeting these challenges. Although biosecurity at the individual farm level is frequently assessed, efforts to summarize this information and obtain a regional overview of biosecurity practices are relatively infrequent. When evaluating biosecurity on a regional scale, it is advantageous to organize farms into meaningful groups. However, one issue we encounter is that the ideal number of groups is unknown. Another issue is that defining a farm according to such a broad variety of practices can be problematic. The importance of each of the recommended practices is debatable, and varies with specific diseases and differing routes of transmission. Two-step cluster analysis has been used previously to cluster pig herds according to biosecurity and management practices (Ribbens et al., 2008; Lambert et al., 2012). Cluster analysis uses objective statistical criteria to group observations based on similar response patterns. As it pertains to this study, this analytical approach is useful in identifying the best number of groups to describe external biosecurity practices on sow farms in southern Ontario, and in providing information about which variables are most important in differentiating between these groups. To the best of the authors' knowledge, this type of work has not yet been accomplished for the southern Ontario swine industry.

The primary objectives of this study were: (i) to summarize external biosecurity practices on sow farms in southern Ontario; (ii) to cluster these farms into discrete biosecurity groups and to describe their characteristics, the variables of importance in differentiating between groups, and their geographic distribution; and (iii) to identify significant predictors of biosecurity group membership.

2. Methods

2.1. Questionnaire

Information about biosecurity practices on sow farms in southern Ontario was obtained through the American Association of Swine Veterinarians' (AASV) Production Animal Disease Risk Assessment Program (PADRAP). One of the surveys offered through PADRAP is the PRRS Risk Assessment for the Breeding Herd (AASV, 2011). Although originally designed to assess the risk of PRRSV introduction and spread within a herd, many of the protocols addressed by this questionnaire are relevant for assessing the likelihood of introduction of other contagious pathogens transmissible through both direct and indirect mechanisms. This survey is widely used by swine practitioners in North America, and the information obtained can be adapted for more generalized purposes. Version 2 of the Breeding Herd survey was used for this study. This version consists of 179 closed- and open-ended questions, divided into three sections: demographic information (24 questions), internal risks (31 questions), and external risks (124 questions).

2.2. Herd inclusion and interviews

The source population for this study was sow herds in southern Ontario. Herds were eligible for participation if they were part of a Statistics Canada census division located in southern Ontario. Information about the study was communicated through the Ontario Association of Swine Veterinarians (OASV) listserv and meetings. Thus, although not a specific requirement, herds were more likely to be included in the sampling frame if their veterinarian was a member of OASV. Members of the study team communicated with members of OASV, and veterinarians provided contact information for clients who were eligible to participate. The team then contacted the producers and arranged a herd visit and an in-person interview. A total of 161 sow sites were included in the study, and the study period was April through August of 2007. Interviews were conducted by three veterinary students with prior experience in the swine industry; these interviewers were trained to administer the questionnaire by members of the AASV who designed it. The majority of interviews were conducted in person, with 6% (9/161) occurring over the phone. Interviews lasted between 40 and 60 min. During the interview, answers were entered into the survey spreadsheet via personal computer. When required, additional information regarding specific disease status was obtained