National seroprevalence of PRRS, mycoplasma, and swine influenza virus

Eric J. Bush[1], DVM, MS; Eileen L. Thacker[2], DVM, PhD; Sabrina L. Swenson[3], DVM, PhD
[1]USDA:APHIS Centers for Epidemiology and Animal Health, Fort Collins, Colorado
[2]Veterinary Medical Research Institute, Iowa State University, Ames, Iowa
[3]USDA:APHIS National Veterinary Services Laboratories, Ames, Iowa

Introduction

Respiratory problems are the most common cause of death among grower/finisher pigs accounting for nearly 40% of deaths[1]. An early description of pneumonia cases involving , porcine reproductive and respiratory syndrome (PRRS) demonstrated that the majority of infections were complicated by other pathogens[2]. The multi-factorial nature of swine pneumonia gave rise to the description of a porcine respiratory disease complex, or PRDC. Three primary pathogens associated with PRDC are mycoplasma, PRRS virus, and swine influenza virus (SIV)[3]. Recently, the USDA's National Animal Health Monitoring System (NAHMS) conducted a national study, Swine 2000. A key objective of this study was to study the epidemiology of PRDC including prevalence, severity of the condition, and a description of control strategies used by producers. The purpose of this paper is to present national estimates of the seroprevalence of these three pathogens based on the NAHMS Swine 2000 study.

Materials and methods

A complete description of the study design of Swine 2000 has been published elsewhere[1]. Briefly, data on swine health and management practices were collected from a stratified random sample of swine production sites in 17 states. The first interview was conducted by enumerators employed by USDA's National Agricultural Statistics Service (NASS) from June 1, 2000 through July 14, 2000. Two additional interviews were conducted by USDA's Veterinary Services (VS) field force on a subset of these sites. The second interview was completed between August 21, 2000, and November 3, 2000 and the final interview was completed between December 1, 2000, and February 28, 2001. Copies of the questionnaires are available from the senior author.

Producers participating in the National Swine 2000 study had the opportunity to submit up to 15 blood samples from late stage finishing pigs (20 weeks of age or older) and up to 30 blood samples from breeding sows and gilts. Samples were tested for antibodies to PRRS virus, *M. hyopneumoniae*, and SIV. The IDEXX ELISA test was used for PRRS and SIV while the Tween 20 ELISA was used for Mycoplasma. Blood was shipped overnight on ice to the National Veterinary Services Laboratories (NVSL) in Ames, Iowa. Sera was spun down and 0.5 aliquots were placed into each of eight separate tubes. One set of sera was delivered to Dr Swenson for evaluation of PRRS and SIV and another set was delivered to Dr Thacker for testing of *M. hyopneumoniae*. A more detailed description of laboratory methods are available from the respective co-authors.

In addition to the management questionnaires administered during the face-to-face interviews, clinical evaluation records were completed for each sampled pig to capture vaccination status, age/parity, and other pertinent information. Data from the questionnaires and clinical evaluation records were processed at the Centers for Epidemiology and Animal Health (CEAH) and merged with ELISA results for each of the three tests. Analysis was conducted using SAS, version 8.02[4]. Weighted estimates of herd and animal level prevalence were generated for inference to all swine operations with 100 or more pigs in the top 17 swine producing states.

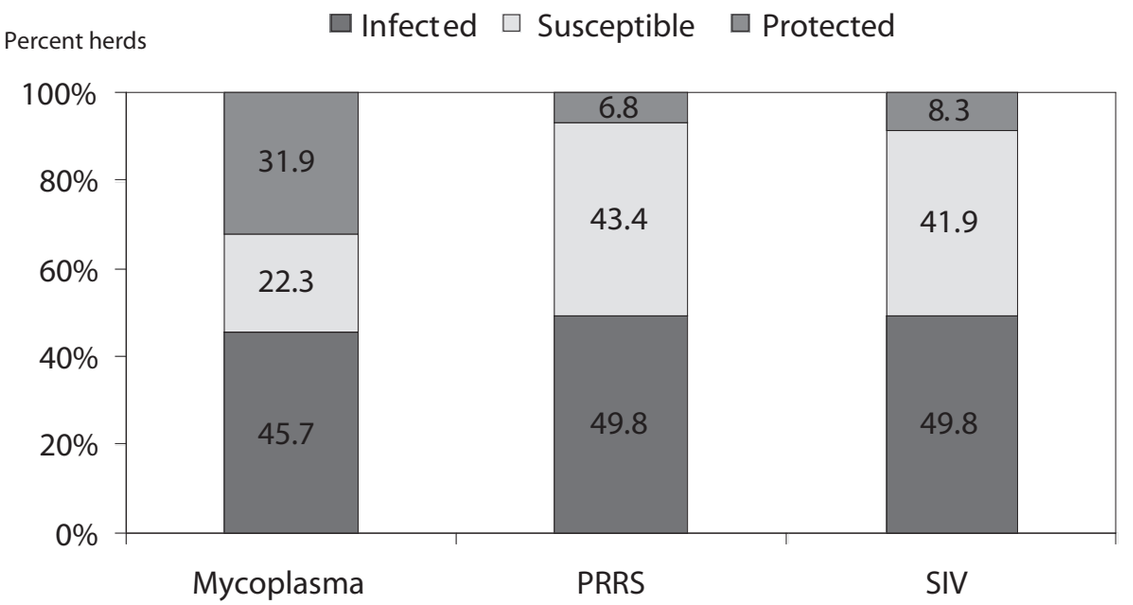
Results

A total of 14,328 samples were collected from 506 swine sites. Of these, 5862 samples were collected from late finishers on 395 sites. Results of serological tests were used to classify finisher herds and finishing hogs into one of three categories: protected, susceptible, or infected.

Herd prevalence

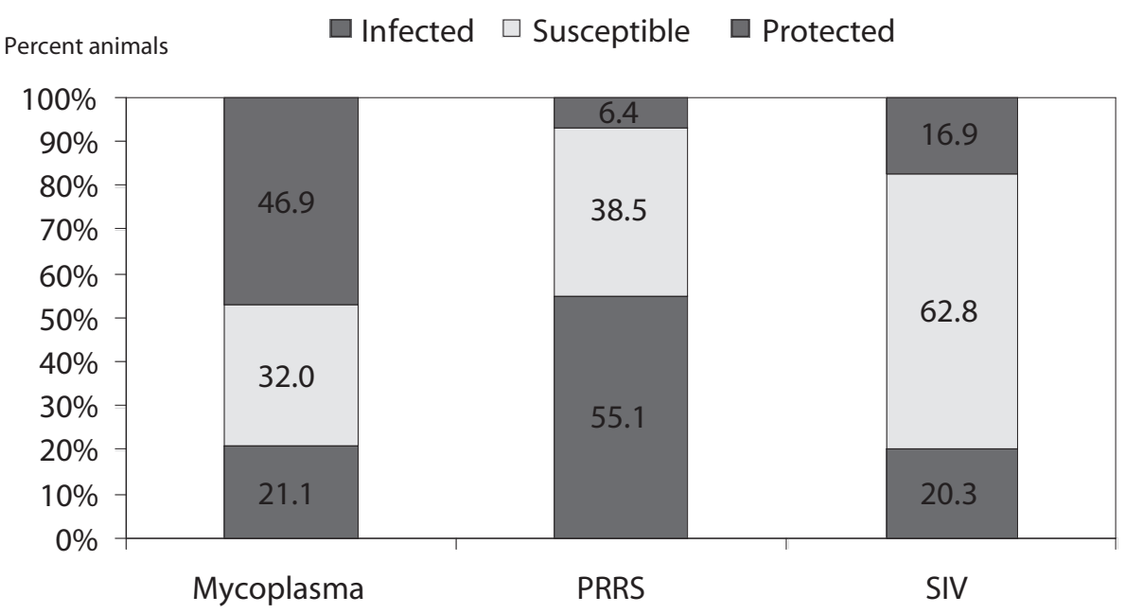
Herds were classified as 'protected' if any finishers had been vaccinated. Almost a third of finishing herds are

Table 1: National estimates of finisher herd prevalence for Mycoplasma, PRRS virus, and SIV. Herd serological status was defined as either infected[1], susceptible[2], or protected[3].



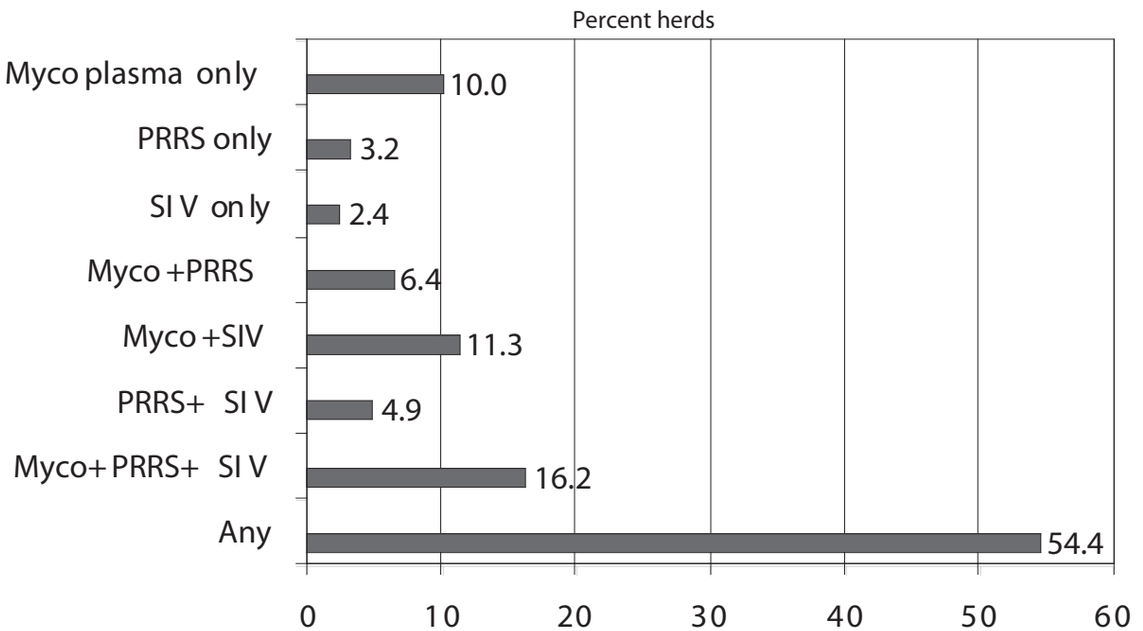
1 Infected herd defined as no vaccine use and at least one serological positive sample.
2 Susceptible defined as no vaccine use and no serological positive samples.
3 Protected defined as use of vaccine in any sampled finishers

Table 2: National estimates of finishing pig prevalence for Mycoplasma, PRRS virus, and SIV. Finisher pig serological status was defined as either infected[1], susceptible[2], or protected[3].



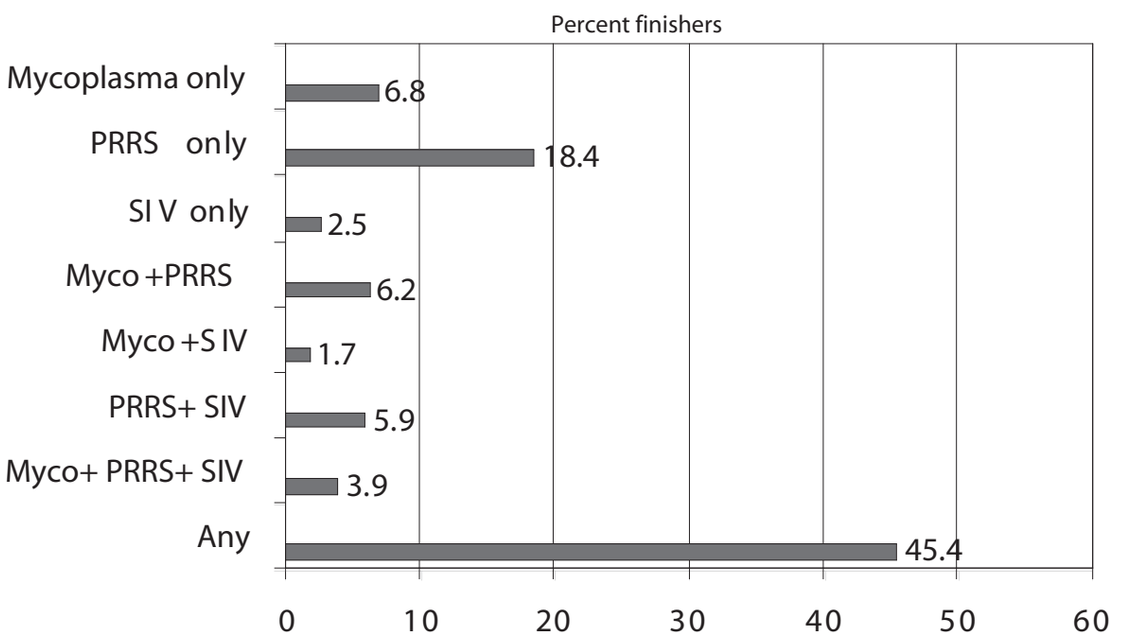
1 Infected finisher defined as not vaccinated and serologically positive.
2 Susceptible finisher defined as not vaccinated and serologically negative.
3 Protected finisher defined as vaccinated finisher

Table 3: National estimates of the percent of finisher herds[1] serologically positive to Mycoplasma, PRRS virus, SIV and their interactions



[1] Percent of all finisher herds, regardless of vaccination status.

Table 4: National estimates of the percent of finishers[1] serologically positive to Mycoplasma, PRRS virus, SIV and their interactions.



[1] Percent of all finishers, regardless of vaccination status.

protected (32%) against mycoplasma whereas fewer finisher herds are protected against PRRS (5%) and either H1N1 or H3N2 SIV serotype(6%). Table 1 presents national estimates of the percent of herds that are either protected against, susceptible to, or infected with *M. hyopneumoniae*, PRRS virus, and SIV. The overall percent of infected finisher herds are similar for the three pathogens (46-50%). However, since vaccination of finishers for mycoplasma is much more common, the proportion of non-vaccinated herds infected is greater for mycoplasma (67%) than PRRS (53%) or SIV (54%).

Animal prevalence

Almost half (49%) of finishers were vaccinated against *M. hyopneumoniae*, while the percent of finishers vaccinated for PRRS and SIV were only 6% and 17% respectively. Table 2 presents national estimates of the percent of finishers that are either protected against, susceptible to, or infected with *M. hyopneumoniae*, PRRS virus, and SIV. More than half of late finishers were serologically positive to PRRS and only a fifth were serologically to mycoplasma and SIV. However, for mycoplasma, 40% of non-vaccinated finishers were infected.

Relative frequency

Tables 3 and 4 provide the percent of finisher herds and finishers respectively that were serologically positive to mycoplasma, PRRS, SIV or any combination of the three primary pathogens of PRDC. Overall, 54% of finisher herds had at least one late finisher serologically positive to at least one of the three pathogens. The most common situation (16% of herds) were finisher herds serologically positive to all three pathogens. However since less than 4% of late finishers were serologically positive to all three pathogens, that indicates that this situation occurred more often in small herds. Conversely, almost one fifth of all late finishers (18%) were serologically positive for PRRS though this situation only occurred on 3% of finishing sites, thus indicating that this situation was more typical of large finishing herds. Mycoplasma was the only pathogen detected in 10% of finisher herds and 7% of finishing pigs.

Conclusions

The NAHMS Swine 2000 national study is a cross-sectional study designed primarily to generate national estimates of management practices and disease prevalence. The actual herd situation has been simplified out of necessity in order to gain a national picture of the epidemiology of *M. hyopneumoniae*, PRRS virus, and SIV. We have assumed that the occurrence of a vaccinated animal in a herd equates to protection and that seropositive status equates to infection. While these assumptions would not hold for every herd / animal, they allow for a valid scientific assessment of the national herd and suggest three distinct epidemiological situations. Very little of the national finisher herd has protective immunity against PRRS or SIV. For PRRS, the majority of the susceptible population is infected and control is based on management strategies. SIV infection occurs less frequently and the national herd remains largely susceptible to SIV. The within herd prevalence of PRRS is relatively higher than SIV where many herds have a few positive animals. For *M. hyopneumoniae*, the majority of herds / animals are either protected or infected. It is likely that many of those classified as susceptible for mycoplasma have been previously exposed and carry some natural protection.

References

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