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Measuring and benchmarking disease risk with the PRRS risk assessment for the breeding herd

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Introduction

Initial design and development of the PRRS Risk Assessment for the Breeding Herd (PRRS Risk Assessment) was done at Boehringer Ingelheim Vetmedica Inc. (BIVI). In March of 2006 BIVI gifted the tool and database of assessments to the AASV, with support from National Pork Board (NPB) and USDA-APHIS. In September of 2006 Iowa State University College of Veterinary Medicine, Food Supply Veterinary Services entered into an agreement with AASV to establish a Disease Risk Assessment Program to develop, manage and promote disease risk assessment tools and databases of completed risk assessments held by AASV.

Through July of 2007, over 500 assessments have been submitted to the database. Assessments have been submitted by 42 assessors and 130 businesses (or production entities). Assessments on breeding herd sites in 18 states in the U.S. and Ontario in Canada have been submitted.

Ninety-six veterinarians have been trained and given access to the PRRS Risk Assessment for the Breeding Herd in American Association of Swine Veterinarians (AASV) sponsored training sessions in the U.S. and Canada.

- June 7, 2007; Des Moines, Iowa (World Pork Expo)
- April 25 & 26, 2007; Stratford, Ontario (Ontario Pork Improvement Council) – 2 sessions
- March 3, 2007; Orlando, Florida (AASV Annual Meeting) – 2 sessions
- November 8, 2006; Ames, Iowa (Iowa State University Swine Disease Conference)
- September 23, 2006; St. Paul, Minnesota (Leman Conference)
- June 7, 2006; Des Moines, Iowa (World Pork Expo)
- 2 others prior to handover to AASV

Upon completion of assessment(s), a standard set of individual site and company risk benchmarking reports are provided to veterinarians upon request.

Since its release, the authors are aware of several ways in which swine veterinarians have applied the current version of the PRRS Risk Assessment for the Breeding Herd as part of the risk management process:

- As a tool to evaluate current biosecurity protocols and/or to develop new biosecurity protocols
- Demonstrate improvement in biosecurity over time to help justify expenditure of resources on measures to improve biosecurity
- An aid in the decision to initiate a project to eliminate PRRSv from a breeding herd site
- As a tool to identify modifiable risk factors in an effort to increase the likelihood that an elimination project will be successful long-term
- An aid in the decision to use a breeding herd site to produce genetic animals
- Part of the due diligence process for purchases or contracting agreements

In addition, four research projects that use the PRRS Risk Assessment are ongoing.

- Quantifying risk and evaluating the relationship between risk score and PRRS-negative herd survival. USDA PRRS Coordinated Agricultural Project (PRRS-CAP). R.B. Baker, D.J. Holtkamp, D.D. Polson, L. Karriker, R.B. Morrison
- An industry education program for understanding the risk factors associated with PRRSv breaks in negative or naïve breeding herds. National Pork Board. D.J. Holtkamp, R.B. Baker, D.D. Polson, L. Karriker, R.B. Morrison
- A cross-sectional study of PRRSv positive swine breeding herd sites to evaluate associations between risk factors and a case definition-based number and severity of clinical PRRSv episodes. Boehringer Ingelheim Vetmedica. D.J. Holtkamp, S.H. Hurd
- Developing PRRS control strategies by understanding how the virus is changing and moving in Ontario. Ontario Pork Industry Council, Swine Health Advisory Board.

Each of these studies, when completed, will enhance the value of the PRRS Risk Assessment by improving our understanding of the relative importance of the risk factors in the PRRS Risk Assessment to various outcomes related to PRRSv. The outcome being related to the risk factors in the 1st and 2nd study is the duration of time a PRRSv negative or naïve breeding herd remains negative. In the 3rd, studies the outcome of interest is the number of clinical PRRSv breaks in breeding herd sites that have been positive for at least three years. A quantitative case definition for the incidence and severity of PRRS breaks that relies upon production data as well, as diagnostic data for confirmation of the involvement of PRRSv, is being developed as part of the 3rd study.

What we are learning

Currently veterinarians completing the PRRS Risk Assessment for the Breeding Herd enter information about the historical number of PRRSv breaks at the site. For this we rely upon the veterinarians subjective assessment and recall of clinical PRRS episodes. Information about various risk factors is collected in a set of questionnaires. The questions are organized into various categories of risk (e.g. location and proximity risks, live animal transportation risks, etc.). The response to each question is associated with a risk weight. As the questions are answered the weights are summed for all questions, except those for which not applicable was the best response, and then averaged for all questions. The resulting average risk score is summarized and reported for all questions as well as for the various categories of risk.

The risk weights are consensus estimates established by using an expert panel and Delphi survey approach (Polson, et al., 2005).

We have begun to mine the assessment data that has been collected to date for relationships between the risk factors included in the PRRS Risk Assessment and the reported number of clinical PRRSv breaks. Some of the findings are presented below. Caution must be used in interpreting the data because of the limitations of the subjective, recall based clinical PRRSv breaks reported. The studies described in the introduction will be used over time to shore up these limitations and improve the value of the PRRS Risk Assessment.

At the highest level, risk factors are categorized into internal and external risks. Internal risk factors are important for the circulation of a virus that is already at the site. External risk factors are those that are important for the introduction of a PRRS virus that is not already at the site. **Figure 1** shows the average number of PRRSv breaks for sites that fall above and below the median aggregated internal and external risk scores of all sites in the database. Sites with both internal and external risk scores above the medians for all sites in the database had on average 1.48 clinical PRRSv breaks in the last two years. Sites below the median for both internal and external risk scores had only 0.43 clinical PRRSv breaks in the last two years.

Figures 2 through **4** show the average number of PRRSv breaks for sites that fall above and below the median for selected sub-categories of risks. The current and historical PRRSv status of the site is a sub-category under internal risks while transportation of live animals and density of pig farms in the area are under external risks. In **Figure 2** sites are divided into those above and below the median aggregated risk score for risk factors included in the category of current and historical PRRSv status of the site. Sites with an aggregated risk score for this category had on average 1.5 clinical PRRSv breaks reported in last two years while those with a score below the median had only 0.51 breaks in the same interval of time.

Figures 3 and **4** present the same information for transportation of live animals and density of pig farms in the area. Sites with an aggregated risk score for density of pig farms in the area had on average 1.27 clinical PRRSv breaks reported in last two years while those with a score below the median had only 0.70 breaks in the same interval of time. The magnitude of the difference for transportation of live animals is relatively small suggesting that the risk factors in this category may be less important when the outcome being evaluated is the number of clinical PRRSv breaks in the last two years. This subcategory may be more important if the outcome being evaluated is the duration of time PRRSv negative or naïve sites remain negative or naïve. The 1st and 2nd studies mentioned in the introduction should provide evidence to support or reject this hypothesis.

Figure 1: Average number of clinical PRRSv breaks in last two years for sites grouped according to their aggregated internal and external risk scores.

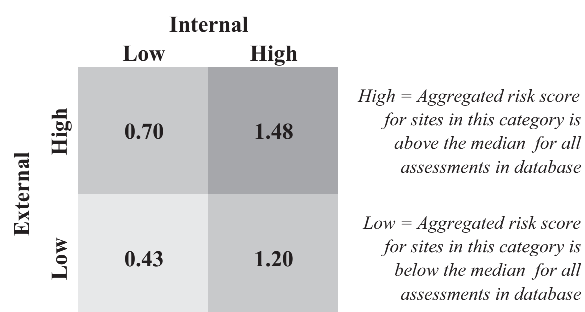

Figure 2: Average number of clinical PRRSv breaks in last two years for sites grouped according to their aggregated risk score for current and historical PRRSv status of the site.

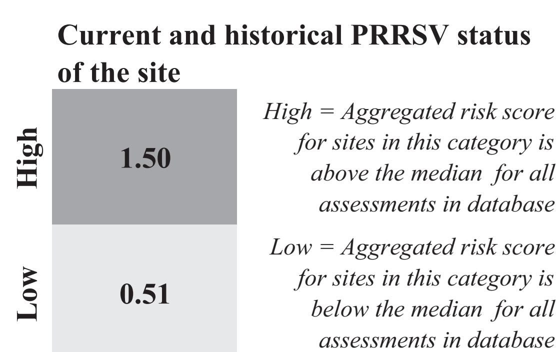

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Figure 3: Average number of clinical PRRSv breaks in last two years for sites grouped according to their aggregated risk score for density of pig farms in the area.

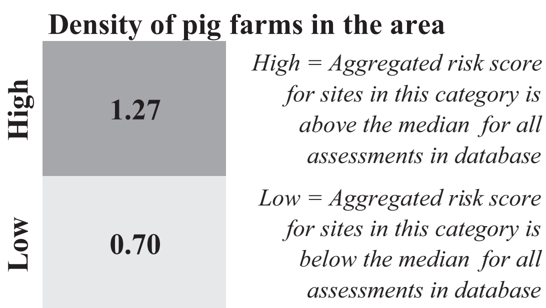
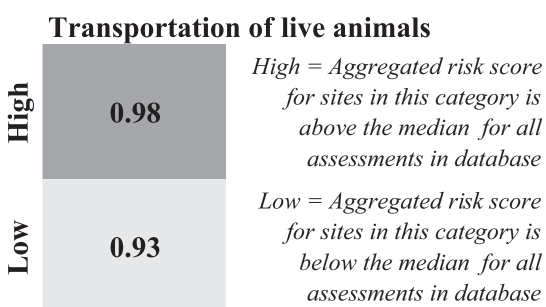


Figure 4: Average number of clinical PRRSv breaks in last two years for sites grouped according to their aggregated risk score for transportation of live animal risks.



Figures 5 and **6** present the average number of PRRSv breaks for sites by the specific response to questions about the parity make-up of the herd and the size of the herd. The average number of breaks over the last two years in parity segregated farms was 1.31 in all gilt farms and only 0.67 in parity 1+ farms. Mixed parity farms reported an average of 0.94 breaks. The average number of breaks over the last two years by herd size shown in Figure 6 suggests that as the herd size increase the number of PRRSv breaks increased as well.

Conclusion

Thanks to the contributions and support of many people, substantial progress has been made on the PRRS Risk Assessment as well as the database of assessments completed and research studies that will enhance the value of the PRRS Risk Assessment. Findings from some initial and cursory analysis of the assessments in the database are presented here. It is the opinion of the authors that these results represent a few drops in a large pond of potential knowledge about the ecology of the PRRS virus that will be mined from the data being collected with the PRRS Risk Assessment.

Acknowledgements

The authors thank the American Association of Swine Veterinarians (AASV). Thanks are also due to the National Pork Board (NPB) and USDA-APHIS for ongoing financial support; and to Boehringer Ingelheim Vetmedica Inc. (BIVI) for the initial design, development and field use as well as ongoing in-kind support of the PRRS Risk Assessment for the Breeding Herd. Special thanks to individuals within those organizations including Tom Burkgren (AASV), Sue Schulteis (AASV), Pam Zaabel (NPB), Paul Sunberg (NPB), David Pyburn (APHIS), John Korslund (APHIS), Reid Phillips (BIVI), Jens Kjaer (BIVI), Dale Spiess (BIVI), Tyler Holck (BIVI).

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Figure 5: Average number of clinical PRRSv breaks in last two years for sites in the database by parity make-up of the herd.

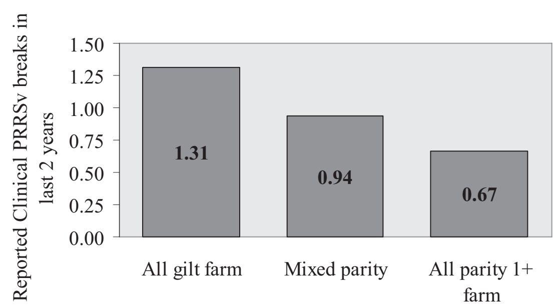
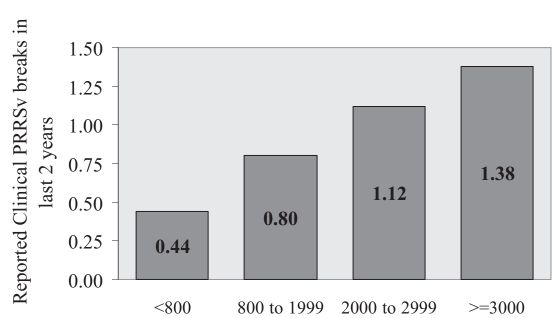


Figure 6: Average number of clinical PRRSv breaks in last two years for sites in the database by size of breeding herd (inventoried females).



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