A Systematic Review of the Evidence for Porcine Reproductive and Respiratory Syndrome Virus Vaccine Efficacy in Reproductive Disease

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Porcine Reproductive and Respiratory Syndrome (PRRS) virus presents clinically in two ways, reproductive manifestations in breeding stock and respiratory manifestations in nursery and grow-finish pigs. The virus reduces farrowing rates on average by 13.8%, pigs weaned per sow farrowed by 1.5 pigs, and pigs weaned per sow per year by 4.7 pigs. The volume of reports about PRRS interventions makes it difficult for practitioners in the field to efficiently access scientific research (past and current) to make an informed decision about the implementation of a PRRS vaccination in their individual situations. The objective of the work described in this abstract is to provide a comprehensive, systematic review and quality assessment of all available research reports evaluating the use of commercial PRRS vaccines in breeding stock.

Systematic reviews address a focused question, using repeatable methods to identify, evaluate, and summarize scientific evidence related to disease diagnosis, treatment and prevention. The goal of a systematic review is to reduce bias during selection of research studies through a systematic process. The transparency of the process allows the reader to judge the conclusion and the strength of evidence used to reach the conclusion. Four steps were followed to produce a conclusion with minimal bias: 1) generate a complete list of all potentially relevant primary research studies 2) screen the studies for relevance using a team of reviewers and standardized criterion, 3) all relevant studies were assessed for quality and, 4) data that passed both relevance and quality criterion were extracted and synthesized. Seven electronic databases including: AGRICOLA (1970-2006), Agris (1975-2006), Biological & Agriculture Index (7/1983-2006), Biosis Previews (1980-2006), CAB Abstracts (1910-2006), Medline (1950-2006) PubMed (1965-2006) and also the 2006 Swine Information CD were searched for the years indicated.

The population of interest was defined as breeding age swine managed in conventional facilities. Breeding age swine consisted of either gilts eligible to breed or sows currently
used for breeding purposes. The outcome of interest was broadly defined as any quantitative measure of reproductive performance including but not limited to: farrowing rate, pigs born alive, stillborn piglets, mummified fetuses, pre-wean mortality, pigs weaned, returns to estrus and abortions. The intervention was defined as the use of a commercially available PRRS vaccine. Commercially available was defined as a vaccine meeting the requirements of the United States Food and Drug Administration or European Union vaccine approval process and available for use in the swine industry.

Quality was assessed using three criteria: 1) randomization, 2) use of a control group and, 3) blinding. A description of the process of randomization was required, contemporary control groups had to be used, and observers had to be blinded to treatment groups. Only articles describing these three criteria were summarized and reported.

The search string yielded 1935 references, 1911 of which resulted from the seven electronic databases and 24 from the 2006 swine information CD. At the conclusion of the relevance screening process, 20 manuscripts remained for quality assessment. The lack of blinding and use of a control group was the most common reasons for failing the quality assessment. At the conclusion of the quality assessment one article survived:

1. Pejsak, Z and Markowska-Daniel. Randomised, placebo-controlled trial of a live vaccine against porcine reproductive and respiratory syndrome virus in sows in infected farms. Veterinary Record (2006). Pejsak used a contemporary control group to assess the outcome of vaccine. The results of the contemporary control trial show a significant difference in returns to estrus, liveborn piglets per sow, and weaned piglets per sow.

At the completion of this review, 20 articles passed the relevance criterion. Of the 20 articles, 6/20 used the word “random” when discussing the allocation of treatment groups. However, only 2/20 articles described the method of randomization. Eight of twenty articles used a contemporary control group. The remaining 12 articles used pre-vaccination herd production records to quantify the effect of the vaccination in place of controls. Drawing conclusions from this type of analysis can be hazardous due to potential over/under estimation of the actual effect of vaccination. The data can over – represent the benefit of vaccine if the clinical picture in the whole herd improves. The data can under-estimate the effect of the vaccine if animals are challenged again after
vaccination. Without control and treatment groups experiencing symmetrical exposure to
challenge, the true effect of vaccine remains unknown. Two of twenty articles reported
the use of blinding. Without blinding, observer bias can occur and skew results in the
favor of one group. An observer making a decision on a stillbirth versus a mummy may
favor one conclusion over another if they were aware of the treatment group. Detecting
returns to estrus is a subjective measure that can be affected by observer bias. Nine of
twenty articles were obtained from conference proceedings, the remaining 11 articles
were peer reviewed. Practitioners using non-reviewed research should be aware that they
bear the responsibility of assessing the validity of the experimental design and analysis as
part of determining the evidentiary value of the conclusions relative to the vaccination
decision they are making.

The high variation in the detail of evidence reported means an exhaustive search is
necessary to insure that practitioners are using the strongest evidence to make decisions
about PRRS vaccination. A cursory search of a single database may not provide the most
complete list of research for practitioners to base decisions on. The Pejsak article was
located in 4/7 electronic databases (CAB abstracts, Pubmed, Medline, and Agricola).
Without a broad set of search terms or access to these databases, this article may not be
located. Through this review process all relevant research was found. This process has
revealed the need for further quality research on PRRS vaccine and its effects on sow
performance. Our evaluation allows us to conclude that there is a large volume of
evidence discussing the effects of PRRS vaccination on reproductive parameters, but the
reports are variable in the consistency of values reported and the approach used to reach
these values. Drawing inference from other than the strongest evidence available may
lead to incorrect conclusions and poor decisions. The use of contemporary control
groups will ensure equal challenge to both vaccinates and controls avoiding mis-
representation of vaccine effect. Random allocation of treatments and controls will
eliminate many potential confounders. If randomization is used, a description should be
included allowing the reader to decide if the procedure is truly random. Blinding
observers to treatment and control groups will prevent confounding due to observer bias.
Finally, inclusion of all relevant reproductive parameters to PRRS including: abortions,
returns to estrus, weak pigs, stillborns, mummies, farrowing rate, pigs weaned and pre-
wean mortality is vital to accurately project vaccine effects. It would be difficult for practitioners in the field to find strong evidence which applies to their specific needs. More specifically, research with strong evidence that measures parameters relevant to their situation. More consistency in the values measured will better serve the needs for practitioners in the field to quickly assess evidence necessary for an informed decision.

