Monitoring breeding herd production data to detect PRRSV outbreaks

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Key points:

- Systematic monitoring of key production performance indicators allowed for early detection of PRRS outbreaks
- Number of abortions was the most efficient parameter, detecting outbreaks up to 4 weeks before being reported to MSHMP
- Early detection of signals associated with disease outbreaks may help in preventing further spread of the virus to other herds, and allowing implementation of rapid response intervention(s).

- The full version of this paper is available at: https://doi.org/10.1016/j.prevetmed.2017.10.012
- If you are interested to enroll herds in an ongoing statistical process control (SPC) project with automated notifications in case of signals, please contact: Linhares@iastate.edu / (515) 294-9358. Data is captured with a secure web-application with farm-specific username and password. Please contact us if you have any questions.

Background: Porcine reproductive and respiratory syndrome virus (PRRSv) causes substantial economic impact due to significant losses in productivity. Thus, production parameters are key indicators of pig health and performance. This study assessed the application of exponentially weighted moving average (EWMA), a statistical process control (SPC) method, on selected production indicators to supplement PRRS surveillance programs by detecting significant deviations in productivity in a production system.

Materials and methods: Two-years worth of reproductive performance data from a production system with 14 breeding herds (1,512 herd weeks) was gathered. Weekly data on number of abortions, pre-weaning mortality (PWM) and difference between total born and born alive (neonatal losses), were merged with weekly MSHMP PRRSV status. A statistical process control method was used to scan production data for significant deviations from baseline (Figure 1). The time-to-detect outbreak, percentage of early detection of PRRSv-associated productivity deviations, and relative sensitivity and specificity of the production data monitoring system were determined relative to the MSHMP.

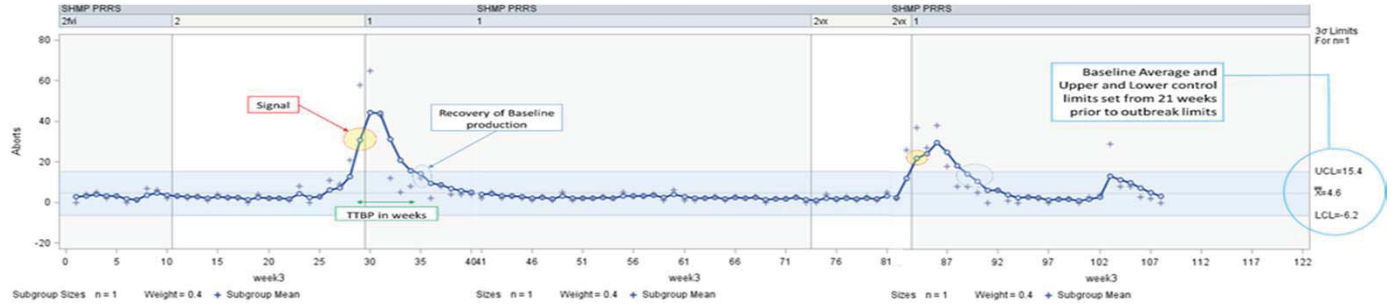

Fig 1. Example of EWMA application to detect significant deviation in abortions, compared to changes in PRRS status over time.

Results and discussion: Abortion signals were detected 1 to 4 weeks before outbreaks were reported to the MSHMP. Most pre-weaning mortality signals coincided with the outbreak date reported to the MSHMP, and prenatal losses signals were detected from 1 to 3 weeks after the MSHMP reported outbreak date (figure 2). Overall, the models had high relative sensitivity (range 85.7 to 100%) and specificity (range 98.5% to 99.6%) when comparing to the changes in PRRS status reported in the MSHMP database.

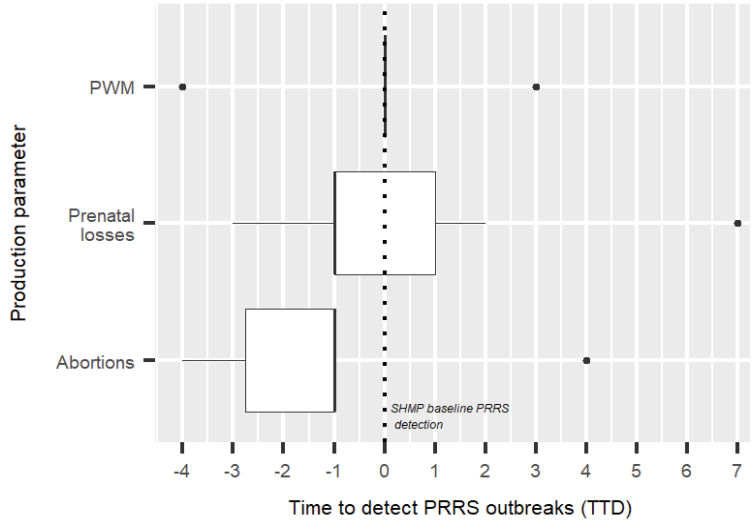

Fig 2. Time-to-detect outbreak for each parameter.

The benefit of detecting signals potentially associated with disease outbreaks allows implementation of rapid response measures to mitigate the infection in the herd (a.k.a. biomanagement). Early detection also helps to prevent the spread of pathogens among farms sharing resources (e.g. sharing vehicles, pig flow, people flow and/or supplies among a production system) (a.k.a. biocontainment).

Conclusion:
In conclusion, systematic monitoring of key performance indicators (e.g. number of abortions) resulted in detection of signals that were closely associated with PRRS outbreaks reported to the MSHMP. Results support the establishment of a prospective on-going monitoring of production data as part of disease surveillance to detect endemic and/or exotic pathogen introduction in production.

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