Reduction of influenza A virus prevalence in pigs at weaning after using custom-made influenza vaccines in breeding herds from an integrated production company over time

Jorge Garrido Mantilla, Juan Sanhueza, Julio Alvarez, Marie Culhane, Peter Davies, Jeremy Pittman, Montserrat Torremorell

Background

- Vaccination is the most common strategy to prevent and control influenza A virus (IAV) infection in pigs
- Influenza vaccine efficacy depends on the antigenic matching of the vaccine virus with the wild-type virus circulating in the pigs and the ability to consistently implement a vaccination program.
- We documented and evaluated the strategy of an integrated swine production company to reduce IAV in pigs at weaning

Objective

- Evaluate the strategy followed by an integrated swine production company on the reduction of influenza prevalence in pigs at weaning over time

Materials and methods

- Thirty-five farrow-to-wean farms belonging to an integrated production system were monitored for 2.5 years.
- The strategy followed by the company included: a) monthly IAV surveillance in pigs at weaning, b) selection of epidemiologically-relevant IAV strains from the herds under surveillance, c) regular updating IAV strains in the company’s custom-made vaccines using a vaccine strain selection process that included analyses of the HA antigenic properties of the vaccine strains compared to circulating strains, and d) seasonal mass vaccination in breeding herds using the company’s custom-made vaccines
- Influenza occurrence was determined by monthly IAV rRT-PCR testing of nasal wipes collected from litters at weaning.
- Custom-made vaccines (A, B and C) were updated 3 times, included a total of 8 strains and were administered 5 times seasonally.
- To evaluate the impact of each vaccine administration, a generalized linear mixed model was built to assess the difference in the % of rRT-PCR results on the 3 consecutive months before and after each vaccination. The model was fitted using the number of positive and negative samples as the outcome and the sampling point (before or after vaccination) as a predictor. Farms that did not use vaccination at each vaccination point were also included to construct the analysis. Herd was included in the model as a ran-
Results:

- 80% (28/35) of farms tested IAV positive. Out of 8,352 rRT-PCR tests, 481 (5.75%) were positive and 68 yielded an HA complete sequence. Fifty-four subtype H1 (22 H1-δ, 28 H1-γ, and 4 H1-pdm clades) and 14 subtype H3 (12 IV-A and 2 IV-B clusters) circulating IAV strains were identified.

- Proportion of influenza positive samples decreased in 2 out of 5 vaccine administrations. During the first vaccine administration, the % positive in vaccinated herds decreased from 7.04% to 2.38% while in the non-vaccinated herds increased from 4.5% to 16.4%. In the second administration period, IAV was reduced from 2.23% to 0.31% in vaccinated herd, and from 1.93% to 0.72% in non-vaccinated herds. There was no IAV reduction in any of the subsequent vaccination periods, but overall the level of IAV detected in the herds was almost negligible.

- The overall HA amino acid similarity between circulating strains and each correspondent vaccine strain ranged from 95% to 99% while the similarity of the HA antigenic sites ranged from 0% to 71%.

Conclusions and implications:

- The results from this 2.5 year analysis using 3 distinct vaccines administered at 5 different time periods indicated a reduction in influenza positivity due to vaccination in 2 of the 5 vaccine administration periods. However, the IAV herd prevalence decreased from 40% to 2.9% throughout the study suggesting that vaccination, in conjunction with other factors, helped contribute to the overall IAV reduction in the herds.

- In this study, we documented the need to have a long term approach to influenza control. The strategy followed required the on-going surveillance and characterization of IAV strains, updating frequently the custom-made vaccines with epidemiologically relevant strains and executing a coordinated supervised plan for vaccine administration.