Considerations for Assessing the Impact of IAV-S in Growing Pigs

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INTRODUCTION

Observational studies have reported the cost of influenza A virus in swine (IAV-S) in swine production systems to range from approximately US$3-10 per growing pig. At this time there is no standard method to assess the impact of interventions targeted against IAV-S. Here we propose key parameters which, when collected in the growing phase, provide insight into the association of pathogens and disease presence with key performance indicators (KPI).

MATERIALS AND METHODS

The measurable unit of growing pigs is defined as a group of pigs that starts and markets together, resulting in a single closeout. Collecting routine measurements in multiple groups over time is necessary for assessment. At group start, document source farm descriptive data including any relevant health history. In each group, routinely collect oral fluids throughout the growth period, testing for the pathogens of interest by PCR (Figure 1a,b and 2c). Perform additional diagnostic investigations with evidence of clinical disease to confirm the presence of pathogens of interest and associate the diagnostic results with the clinical picture in the barn. Additional objective, clinical data collection includes monitoring cough routinely with app based tools (figure 2a) or other sound technology. Individual pig treatments for secondary infections may also be recorded (Figure 2b), although they will likely lag behind the influenza infection. Individual mortality records should also be recorded, although a longer lag exists (figure 2b). Final closeout reports including daily gain, culls, and other system KPIs should be associated with each group, and used in the assessment.

RESULTS

In process data should be collated and charted. An example of biweekly oral fluid (OF) monitoring for key respiratory pathogen detection over time in a growing pig population using commercial screening PCR assays for IAV-S, PRRSV and Mph is reported in Figure 1. Consistent and prospective data can be aggregated over multiple groups of animals for in depth analysis and association with KPIs (Table 1).

DISCUSSION AND CONCLUSION

Recently, Stika et al., using K-Means Clustering for pathogen burden by grow-out time point, found associations with pathogen pattern in routine oral fluids diagnostics, and mortality. The analysis demonstrated average total mortality was highest when pathogen burden increased through the nursery phase, and it became significantly worse when multiple pathogens were observed in a similar pattern.[1]

Systematic methods for measuring, reporting and associating the presence of pathogen with clinical disease and performance parameters, will provide a more objective assessment of the success of intervention strategies targeted against IAV-S.

Figure 1.
a) Biweekly oral fluid PCR monitoring for IAV-S, PRRSV and Mhp in a single group of growing pigs (blue: IAV-S, green: PRRSV, Red: Mph) from weaning to market. b) Table of "burden" of pathogen (+/- for IAV-S, PRRSV or Mhp: "x of 3") by OF sampling for 28 groups of pigs, with associated reported total % mortality and avg. weight gain.

Fig 1a

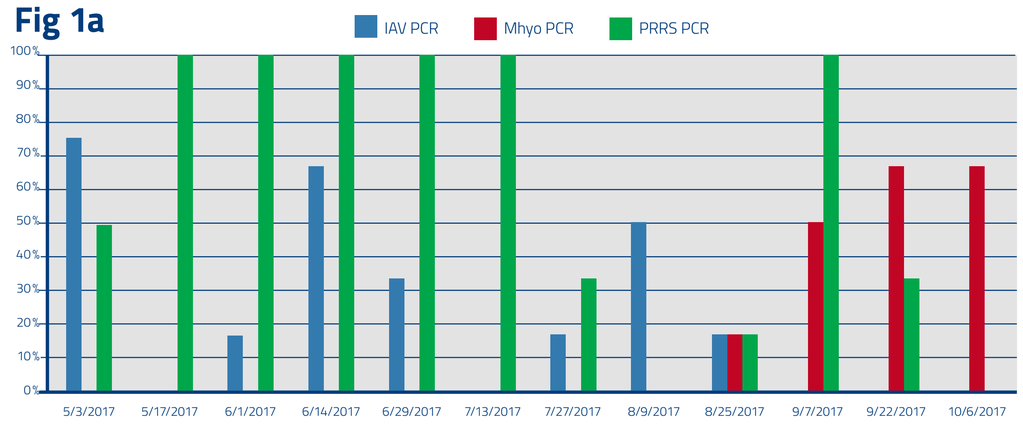

Fig 1b

Pathogen Load														
Site	OF sampling period												Total ADG	Total Mortality
	wk1	wk 3	wk5	wk7	wk9	wk11	wk13	wk15	wk17	wk19	wk21	wk23		
S	2	2	2	2	1	1	1	0	0	0	0	0	2.40	3.58
U	2	2	2	3	2	2	1	2	1	1	1	2	2.34	4.89
T	0	1	1	1	1	1	1	1	1	1	1	1	2.33	7.51
A	2	2	2	2	1	1	2	2	1	0	1	1	1.76	4.27
Y	0	0	0	0	0	0	0	0	1	0	1	x	1.74	2.59
F	0	0	0	0	0	0	0	1	1	x	x	x	1.73	4.85
E	0	1	1	0	1	0	0	0	0	0	x	x	1.73	4.43
BB	0	0	0	0	0	0	0	0	0	1	1	x	1.72	6.41
C	2	2	2	2	3	2	3	3	0	0	0	0	1.71	3.63
AA	0	0	0	0	0	0	0	0	0	0	0	x	1.70	2.64
I	2	2	1	1	2	2	2	1	1	0	x	x	1.67	3.77
P	1	1	1	1	1	1	1	1	1	1	1	x	1.64	3.98
H	2	2	2	2	2	0	1	0	0	0	x	x	1.64	3.69
Z	1	1	1	0	0	0	0	0	x	x	x	x	1.63	8.10
J	1	2	1	2	1	2	1	1	1	1	x	x	1.63	7.16
X	1	1	1	0	0	0	0	x	x	x	x	x	1.63	1.79
G	1	1	2	1	2	1	1	1	0	1	x	x	1.62	5.82
B	2	1	2	2	2	1	2	1	3	2	2	1	1.62	3.85
R	1	1	1	1	1	1	0	0	0	0	0	x	1.60	5.58
K	2	1	2	2	1	1	1	1	1	2	0	x	1.60	5.20
N	2	2	2	2	2	1	1	1	1	0	0	x	1.58	6.57
O	0	1	2	1	0	2	0	0	0	0	2	x	1.58	4.22
V	0	1	0	1	1	0	1	0	0	2	0	x	1.56	4.02
D	1	1	1	1	1	0	0	1	2	x	x	x	1.54	8.86
L	2	2	2	2	2	1	1	2	2	1	0	x	1.54	4.80
M	1	1	2	2	2	2	1	1	0	1	1	x	1.54	4.39
DD	2	2	2	0	1	1	1	0	0	0	x	x	1.33	5.97
Q	0	1	1	2	1	1	1	2	2	0	x	x	1.31	12.90
CC	2	2	2	2	0	0	2	2	1	0	0	x	1.31	7.51

Figure 2.
In process data from one cohort of pigs by calendar week of production.
a) weekly average cough index score (Cough Index Calculator, BIVI, Ingelheim, Germany); b) weekly treatments (purple line) and mortalities (black bar);
c) antibody ELISA detection (yellow, PRRSV; red, Mph) and antigen nucleic acid detection by pen-based OF PCR (blue, IAV-S; yellow, PRRS). IAV-S detection is noted prior to increased incidence of cough and mortality waves.

REFERENCES

1. Stika et al., Assessment of the association between respiratory pathogen burden and the productivity of growing pigs. 2018 AASV conference, San Diego, CA. Poster presentation.