The risk of disease introduction in swine breeding herds in Quebec, Canada: what about the persons entering the units and the biosecurity measures at the entrance?

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Introduction and objectives

Persons are at risk of carrying contaminated fomites within swine breeding herd and biosecurity measures must be adapted to prevent the introduction of pathogens. The objectives were to:

- describe the type and number of different persons entering the breeding unit over a one-month period;
- evaluate the association between the number of persons and biosecurity measures.

Materials and methods

Study design, source population and data collection

A retrospective observational study was conducted on swine breeding sites in Quebec, Canada. As part of a larger project, sites with ≤4 pig units, which had a porcine reproductive and respiratory syndrome (PRRS) virus introduction between August 1, 2014, and July 31, 2017 were selected.

- The type and number of different persons entering the breeding unit over a one-month period were collected using a questionnaire or logbooks if available.
- Biosecurity measures at the entrance were assessed for staff and for visitors using a questionnaire (always / occasionally / never).

Statistics

- Descriptive statistics on the type and number of distinct persons with access to the breeding unit over the one-month period.
- Exact Chi-square test to evaluate the associations between the number of distinct persons and biosecurity measures.
  - Dichotomization of the number of staff and the number of visitors using their respective median.
  - Dichotomization of biosecurity measures as always or not always (occasionally/never) implemented.
  - Associations evaluated separately for staff and visitors, with alpha value set at 0.05.
- Two multivariable linear regression models to evaluate the association between breeding herd characteristics and the number of staff or number of visitors as outcome. Predictors were sequentially removed (P >0.05) from the full model:
  - Number of sows;
  - Production type (integrated farrow-to-wean, independent farrow-to-wean, farrow-to-grow/to-finish);
  - Time interval between batch farrowing (<4 weeks, =4);
  - Number of pig sites in a 5-km neighborhood radius.

Results

Owner's participation was obtained for 87% of the detected PRRS virus introductions.

Characteristics of the 84 investigated sites were:

- 675 median sow inventory;
- 74% farrow-to-wean, 26% farrow-to-grow/to-finish;
- 48% independent, 52% integrated production system;
- 58% with 4-week, 42% with <4-week batch farrowing.

The median (Q1-Q3) number of distinct persons (staff and visitors) over a one-month period were 7 (4-10). The maximum was 24. At least 1 visitor was observed on 87% of the sites (Table 1).

Table 1. Frequency of visited sites according to different categories of persons over a one-month period and to the distribution of the number of distinct persons in the 84 swine breeding sites.

Categories of persons	Number of visited sites (%)	Total number of distinct persons in visited sites			
		1	2-4	5-9	≥10
Farm staff[1]	84 (100)	0	46	30	8
Visitors					
Maintenance[2]	37 (44)	11	23	3	0
Technical services[3]	53 (63)	44	9	0	0
Exterminator	35 (42)	35	0	0	0
Washing unit team	9 (11)	7	2	0	0
Teaching, training, research	10 (12)	4	4	2	0
Veterinarian	21 (25)	21	0	0	0
Inspection or certification[4]	6 (7)	6	0	0	0
Others	6 (7)	4	2	0	0
All visitors	73 (87)	21	31	16	5

[1] Farm staff includes regular and part-time employees, pig owners and site owners.
[2] Maintenance personnel (e.g., maintenance of plumbing, electricity, welding, building, pig watering system, swine manure storage system, feeding system, propane tanks, fuel tanks).
[3]Technical service (animal health technician, agronomist, company representative, information technology/computer, laundry).
[4]Inspection and certification by the Canadian Pork Excellence, Canadian Food Inspection Agency, insurance companies.

Associations between the number of persons and biosecurity at the entrance

- Having more visitors was associated with a higher probability of logbook signature for visitors and to a better entrance protocol for visitors (Table 2).

Table 2. Association between the frequency of distinct persons entering the breeding unit over a one-month period and biosecurity at the entrance in breeding sites reporting staff and visitors.

Biosecurity measures for staff and visitors	Staff (n=84 sites)		Visitors (n=73 sites)	
	Number of sites	Number (%) with ≥4 distinct staff	Number of sites	Number (%) with ≥3 distinct visitors
Locking of main entrance door				
Always	49	30 (61)[a]	48	30 (63)[a]
Not always	35	19 (54)[a]	25	10 (40)[a]
Signature of logbook				
Always	6	5 (83)[a]	28	21 (75)[a]
Not always	78	44 (56)[a]	45	19 (42)[b]
Shower-in or delimited entrance[1] with changing coveralls and boots and washing hands				
Always	49	31 (63)[a]	51	32 (63)[a]
Not always	35	18 (51)[a]	22	18 (36)[b]

[a,b] For each biosecurity measure, different superscripts indicate the proportions significantly different (P <0.05) based on exact Chi-square statistic.
[1] Contaminated and clean areas of the entrance are visually (line) or physically (bench, raised floor) delineated.

Associations between the number of persons and breeding herd characteristics

- Sow inventory was the only significant predictor (P <0.001) into both staff and visitors final models.
- A 100-sow increase in inventory was associated with a 0.34 (S.D.=0.05) increase in the number of staff or a 0.30 (S.D.=0.05) increase in the number of visitors.

Discussion

- Up to 24 distinct persons were observed over a one-month period. Since only persons entering the breeding unit were considered, the number of persons with access to the site is certainly higher, particularly on sites with multiple pig units.
- On 70% of the sites, a shower or a 3-zone delimited entrance with changing coveralls and boots and washing hands was required for visitors to mitigate the risk of pathogen introduction via contaminated fomites. An entrance with an intermediate area establishing a clear delimitation between clean (inside) and dirty (outside) areas can be easily set up. Even when an adequate protocol is required, the compliance may remain a challenge.
- Only 38% of the sites had their logbook signed by all visitors who entered the breeding unit. This measure is simple but crucial, especially during outbreaks when traceback investigations are set up to control emerging or exotic diseases.
- The association between the visitors and presence of a signed logbook might be partly due to a higher level of reporting for sites with logbooks which are less susceptible to recall bias compared to sites with data obtained from interviews.
- Herd size is frequently reported as risk factor for a variety of diseases. In this study, a 100 increase in the number of sows would result in a 0.34 and 0.30 increase in the number of staff and visitor, respectively, and this could be one of the underlying mechanisms involved into a herd size effect.

Conclusion

A considerable traffic of staff and visitors was observed which emphasises the importance of an adequate entrance protocol. Various types of deliveries, live pig transportation as well as other vehicles accessing the site could also increase the risk of pathogen introduction in breeding herds and these were also investigated within the larger study (results not shown). External biosecurity is an essential tool to prevent both endemic and exotic diseases.

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