Modelling *Salmonella* spread in a pig farm under three biosecurity strategies

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INTRODUCTION

The production level is a critical point of the contamination of the whole pork supply chain by *Salmonella*.

Objectives : To estimate the number of shedder and carrier pigs at slaughter age under three biosecurity strategies.

MATERIAL & METHODS

1. Development of a **stochastic mathematical model** to simulate:
   - the pig **population dynamics** (Fig.1) in a farrow-to-finish herd with batch farrowing management;
   - the **transmission of *Salmonella*** depending on the contamination of the pen floor (Fig. 2).

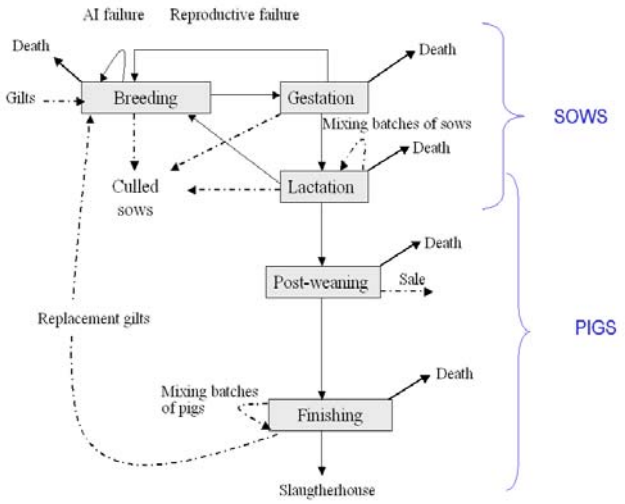

Figure 1. Simplified farrow-to-finish herd production system.
flows linked to demographic processes
flows controlled by producers

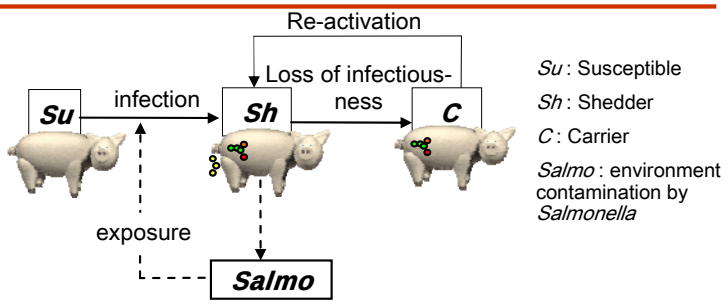

Figure 2. Epidemiological model.

Contact structure influenced by:
- the variability in reproduction and in growth,
- the producers' management,

→ leading to variations in the transmission.

Groups of slaughtered pigs were issued from several batches depending on their weight.

Parameters: from published literature and expert opinion.

2. The three **biosecurity strategies** differ only for finishing pigs:
   AIAO strict all-in/all-out management with complete cleaning, disinfection and drying period between batches;
   NDP all-in/all-out allowing the suppression of the drying period;
   BM management allowing the suppression of the drying period and batch mixing.

3. **Simulations** were run after the introduction of a shedder gilt in a AIAO herd. After equilibrium, the 3 strategies were implemented.

RESULTS

The number of batches in a group of slaughtered pigs was significantly higher under the BM strategy (Tab. 1).

Table 1. Proportion of groups of pigs at slaughter per number of batches under the three biosecurity strategies.

Biosecurity strategy	Number of batches			
	1	2	3	>3
AI/AO	0.18	0.34	0.30	0.18
NDP	0.21	0.35	0.27	0.17
BM	0.15	0.20	0.31	0.34

Prevalence of shedder and carrier pigs varied widely between batches, within and between strategies (Fig. 3).

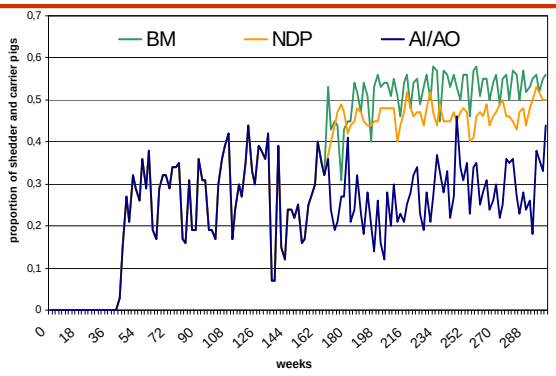

Figure 3. Prevalence of shedders & carriers at slaughter age.

Mean prevalence differed significantly between strategies. **AIAO**: 0.27±0.04, **NDP**: 0.45±0.02, **BM**: 0.53±0.01.

DISCUSSION & CONCLUSION

A less strict management increased dramatically the number of shedder and carrier pigs at slaughter age.

Further validation of the model based on field data is considered.

Both the heterogeneity of the contact structure and the biosecurity strategies play a major role in pathogen transmission in a farrow-to-finish herd.

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