

Modelling spread of MRSA within a pig herd

Anna Irene Vedel Sørensen¹, Nils Toft¹, Carmen Espinosa-Gongora¹, Kaare Græsbøll¹, Anette Boklund¹, Jesper Larsen² & Tariq Halasa¹

¹Division of Diagnostics and Scientific Advice, National Veterinary Institute, Technical University of Denmark, ²Microbiology and Infection Control, Statens Serum Institute

Objectives

- Study the spread and persistence of MRSA (methicillin-resistant *Staphylococcus aureus*) within a pig herd
- Examine short and long term consequences and cost-effectiveness of different potential control strategies

Material and methods

- A mechanistic individual-based simulation model was built in R
- Herd model: A medium-sized Danish farrow-to-finish herd
- Infection model: SIS model with two different 'infectious stages': Intermittent or persistent MRSA shedder
- Due to uncertainty, all scenarios were modelled with three different sets of transmission rates ('low', 'medium', 'high'), estimated based on Broens et al. (2012)

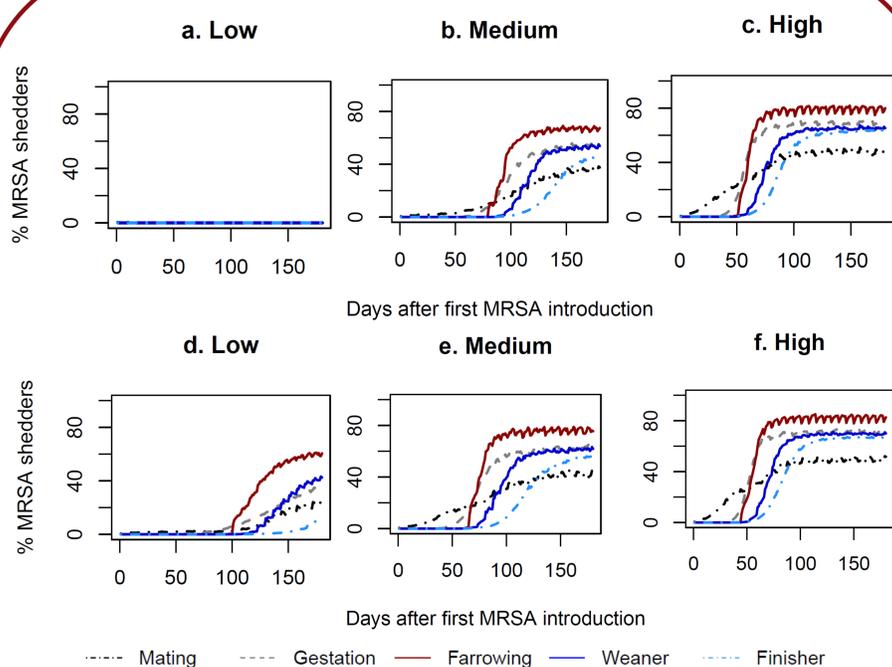


Fig.1: Median simulated proportion of MRSA shedders after introduction of one intermittent (a-c) or persistent shedder (d-f) in the mating unit under low*, medium* and high* transmission of MRSA

*Rates calculated from Broens et al. (2012). High: Use of tetracyclines or β -lactams for min. one pig/pen, Low: No use of these antibiotics, Medium: Average of low + high

Key observations

- Development over time after introduction (Fig. 1): Spread of MRSA was mainly following the movement of pigs between stable units
- Following introduction of lower numbers of intermittent shedders, MRSA would frequently fade out (Fig.1.a + Fig. 2.a)
- After spread of MRSA has reached an equilibrium, the prevalence of MRSA shedders would be highest in the farrowing unit (Fig. 2), independent of how MRSA was introduced

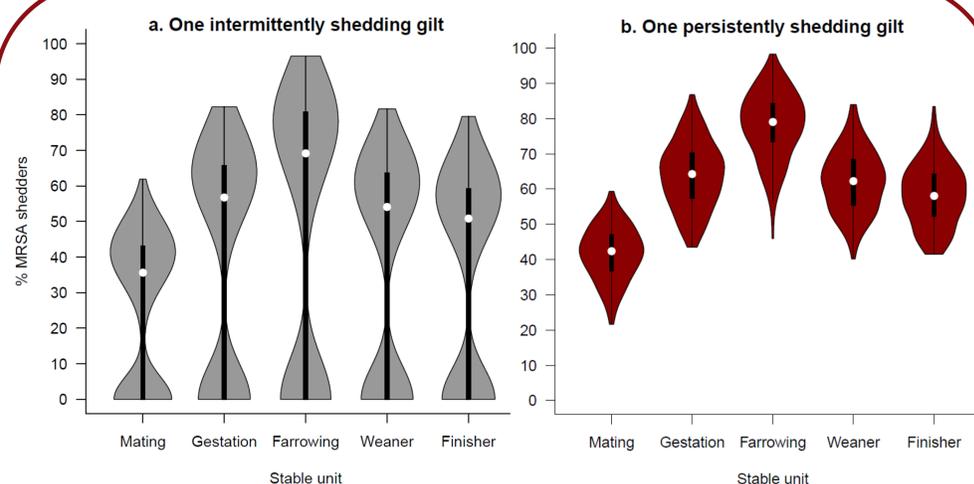


Fig. 2: Simulated proportion of MRSA shedders in the five stable units six years after introduction of one intermittently (left) or persistently (right) shedding gilt, based on 500 iterations (medium transmission rates)



References

Broens, E.M., Espinosa-Gongora, C., Graat, E.A.M., Vendrig, N., Van Der Wolf, P.J., Guardabassi, L., Butaye, P., Nielsen, J.P., De Jong, M.C.M., Van De Giessen, A.W., 2012. Longitudinal study on transmission of MRSA CC398 within pig herds. BMC Vet. Res. 8, 58. doi:10.1186/1746-6148-8-58

Acknowledgements

This study was supported by a grant from the Danish Ministry of Environment and Food through The Danish Agrifish Agency (J. no. 33010-NIFA-14-612)

