



PROJECT REVIEW

NAME: Daniel Franklin	
INSTITUTE: University of Warwick	FULL TIME Final Year
TITLE: Enhancing the impact of Regional Health Improvement Programme	
AIMS & OBJECTIVES:	
<p>To develop mathematical simulation models to help understand the role of the metaherd in the spread of Porcine reproductive and respiratory syndrome virus (PRRSV). To use these models to test control and intervention strategies across the metaherd.</p>	

KEY MILESTONES:	TARGET DATE:	ACHIEVED DATE:
<ul style="list-style-type: none"> • Complete testing of metaherd model. • Parameterise vaccination for entry into the model. • Simulate the use of vaccinations in the metaherd drawing conclusions on optimal strategies. • Complete writing up chapter, including: <ul style="list-style-type: none"> • Results of PRRSV in metaherd structures. • Results of different permutations of vaccination strategies in a representative metaherd. • Analysis of pig movement data in GB. • Complete thesis and write report for BPEX. 		October 2013
		November 2013
		November 2013
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	December 2013	November 2013
	December 2013	2013

<p>PROJECT REVIEW AND COMMENTARY:</p> <p>Porcine Reproductive and Respiratory Syndrome (PRRS) is a persistent heavy burden on the pig industry internationally. The aim of this project is to investigate the role of metaherds on the transmission and persistence of this disease, and then to test control and intervention strategies to provide predictive results to the UK industry on optimal strategies.</p> <p>A metaherd is a population herds with their own individual dynamics, but also with some interaction between the herds. The interaction is the movement of pigs between herds.</p> <p>I have developed a stochastic model framework to simulate the transmission of infection through a metaherd. This models the demographic processes involved within the herds of births, deaths and movements. That is the movements of pigs within the associated housing structure in a herd, and also the movement of pigs out of the herd. The model also captures the movement of pigs between herds. The model framework then simulates virus transmission within this metaherd. The model has been parameterised to represent PRRSV. The model outputs production losses such as mortality, reproductive failure and the failure of rearing pigs to gain weight due to infection.</p> <p>RADAR data of pig movements has revealed complex and rarely straightforward networks of pig movements, including glaring occurrences of ill-advised movements such as pigs moving back up the production pyramid. The movement data was then used to inform parameterisation of the metaherd in the model, taking account the distribution of herd sizes and number of source herds, and the distribution of the number of pigs per pig movement in the metaherd. This allowed the generation of representative metaherds that most closely resembled the structure of metaherds in GB. The ability to generate multiple metaherds from these distributions meant that multiple metaherds could be tested to observe whether they had altered the way PRRSV was transmitted and persisted. The results indicate that the results do not differ and that modelling an exact metaherd is not necessary providing the metaherd has the same overall characteristics.</p> <p>Further to modelling the role of the metaherd in the transmission and persistence of PRRSV, the model was used for testing the intervention and control of PRRSV within the metaherd. Vaccination was used as the control method, which was parameterised and added to the model. There were different viewpoints to consider. As a vaccination strategy that most benefits a single herd may not be beneficial for another herd and the optimal strategy for the metaherd (and thus the industry) may have differing impacts on different herds within the metaherd. This difference in outcome at the herd and the metaherd level is an important distinction and result.</p>



POTENTIAL BENEFIT TO INDUSTRY:

1. The results of the analysis of the movement data may allow the industry to advise on or re-structure the links formed between herds by the movement of pigs.
2. The results of the transmission and persistence of PRRSV in a metaherd may allow the industry to restructure metaherds to minimise the success of PRRSV transmission and persistence.
3. The results of the control and intervention testing could be used to guide advice on how to best eliminate or control PRRSV to improve production.

SUPERVISOR: Professor Graham Medley & Professor Laura Green

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Notes from Seminar: