Name:	Daniel Franklin		
Project title:	Enhancing the impact of Regional Health Improvement Programmes		
Institute:	University of Warwick		
Start date:	October 2010	**Finish date:**	September 2013

Lay summary of project (*in your own words*)

The pig farming industry and farming industry in general must deal with disease among other challenges. My research aims to identify the impact of porcine reproductive and respiratory syndrome (PRRS) on the British pig industry. PRRS causes reproductive losses in sows such as abortions, still born and mummified piglets. It also causes respiratory problems in pigs being reared for slaughter, which can slow their growth or even be fatal. One of the most damaging aspects of PRRS is that it compromises the immune system making the likeliness of contracting other diseases more likely.

PRRS has been present in the British pig industry for approximately 20 years, and is past the 'outbreak' state where losses are high and is at a constant level. PRRS virus is present in two thirds of all British farms; half due to active virus, and half due to the use of vaccine. The vaccines available are not perfect and come at a cost, so that a farmer has to decide if using the vaccine will make more profit.

A key idea for my project is that pig farms are highly connected. Pigs move between them for the purposes of breeding and rearing. This creates a network of connected farms (a "metaherd"). This means that PRRS does not exist in each farm independent of another, so that, for example, a farmer deciding to vaccinate has an impact on all the other farms.

I have written a computer model to simulate a network of pig farms, including realistic demographic processes (births, deaths and movements) taken from industry data. The simulation records production measures such as mortality, whether pigs are underweight and reproductive measures like abortion, and failure to become pregnant. All of these translate into the profitability of breeding and rearing pigs.

Modelling of this kind is beneficial to make observations and predictions. I am able to repeatedly simulate long periods of time, to observe the most likely outcomes, and try out many different interventions.

Results so far suggest that the pattern of PRRS in a network is largely influenced by the size of the herds. In smaller herds there are not enough pigs to sustain the infection, and the infection is removed (either by recovery or death) before spreading to the larger population of pigs on a farm and beyond. Even when small farms continually bring in infected pigs, the disease normally spreads no further.

The model shows that the levels of abortions and failure to become pregnant are increased for the whole metaherd, and the levels remain constant. However at the individual farm level, the results show mostly healthy levels. The individual farms then suffer further

‘outbreaks’ of abortion and failure to impregnate, which last only a matter of weeks at most before returning to normal levels. These minor outbreaks may not be observed or perhaps not attributed to PRRS when they occur.

The number of pigs being reared for slaughter for the whole metaherd is markedly decreased at a stable level. The mortality of these pigs is higher when PRRS is present, and those that survive to slaughter age are underweight in comparison to healthy pigs of that age. On an individual farm results can vary over time, and also between farms. In the case that pigs are underweight and mortality levels are stable, this effect of PRRS can again be missed.

The model therefore increases our understanding of what impact PRRS can have on a farm, and also on the whole network of farms. Knowing this, the model becomes a tool for testing what is the best way to prevent the losses caused by PRRS, and thus improve the performance of individual farms and the industry as a whole.

A general result is the difference between the viewpoints of the whole industry and individual farmers. Because of the variability between farms and regions, not all farmers believe that control and vaccination are worthwhile for them, and they are, from an individual perspective, right. But from the viewpoint of the industry, PRRS is a significant problem. This work highlights that rational individual farmer decisions represent a significant barrier to optimal control of diseases in pigs.

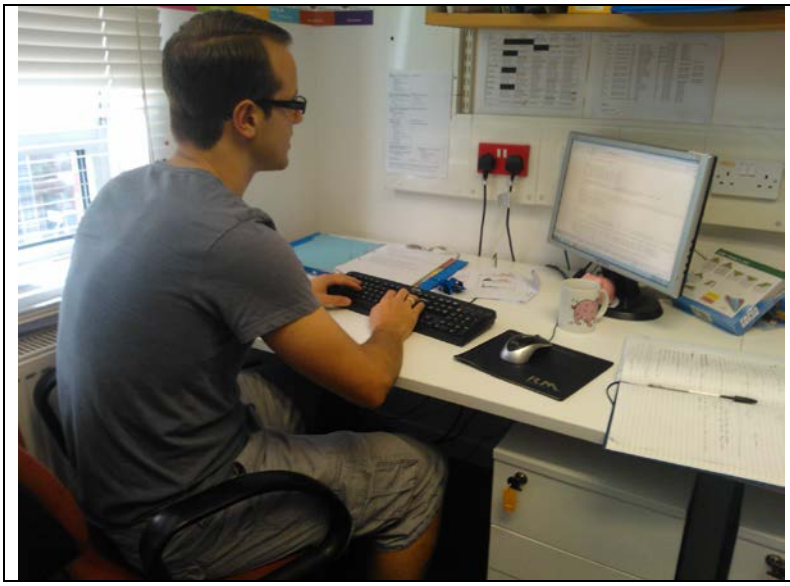
A bit about yourself (*one paragraph*)

I originally trained as a mathematician, which gives me modelling and computational skills to use on this biological problem. I have been working on this project for 3 years, and will in the near future be completing it and presenting detailed results to the pig industry.

What you hope to get out of your PhD

Firstly a broad understanding of the field of research in which my work sits: infectious disease epidemiology and modelling. The close links to industry of my PhD have allowed me to develop an understanding of the pig industry, and the challenges it faces in remaining profitable.

A photograph of your work



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Signature: Daniel Franklin Date: 25.09.2013