

The Risk of Exporting Infected Pig Carcasses after Eradication of Foot-and-Mouth Disease by Emergency Vaccination

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ABSTRACT

Control of foot-and-mouth disease (FMD) by emergency vaccination brings about a six month waiting period after the last detection or last vaccination before exports can be resumed. The extension of the waiting period in comparison to control by stamping out has severe economic consequences for pig exporting countries. In this study the risk of exporting carcasses from a vaccinated area (a) directly after final screening and (b) after a six-month waiting period was analysed. A risk model was built to calculate the probability that a processed carcass is derived from an FMD-infected pig (P_{carc}). Bayesian inference was used to estimate herd prevalence and within-herd prevalence. Model calculations indicated that the average value of P_{carc} was 2.0×10^{-5} directly after final screening and 1.7×10^{-5} after a six-month waiting period. The additional waiting time thus did not importantly reduce P_{carc} .

Keywords: Bayesian inference, foot-and-mouth disease, freedom of disease, pigs, prevalence estimates, vaccination

INTRODUCTION

Control of foot-and-mouth disease (FMD) by emergency vaccination brings about a six-month waiting period after the last detection or last vaccination before exports can be resumed. If no vaccination is applied, the area is declared free from FMD three months after the last detection. Besides, EU legislation prescribes a final screening at 30 days after the last detection or last vaccination consisting of clinical inspection and serological testing. If no positive results are obtained, the area is assumed to be free from FMD, although some infected animals might have been missed due to sampling and use of imperfect tests. The goal of this study was to analyse the risk of exporting pig carcasses from a vaccinated area (a) directly after final screening and (b) after a six-month waiting period.

MATERIAL AND METHODS

A risk model was built to calculate the probability that a processed carcass is derived from an FMD-infected pig (P_{carc}). Leading variables were herd prevalence (P_H), within-herd prevalence (P_A), and the probability of detection at slaughter (P_{SL}). P_H and P_A were estimated using Bayesian inference under the assumption that, despite all negative test results, ≥ 1 infected pig was present. The prior distribution of P_A was derived from final size calculations assuming a basic reproduction ratio R_0 of 2.42. Distributions of the likelihood that only negative test results were obtained given ≥ 1 infected animals present in the herd were combined with this prior to infer the posterior P_A . Test sensitivity, sample size, and number of repetitions were the main determinants of these likelihood distributions and differed between detection methods (serological testing, clinical inspection, and 'waiting'). Calculation steps for P_H were similar, but an uninformed prior was used. Experimental data were used to estimate the sensitivity of detection methods and P_{SL} . Calculations were carried out in Excel and @Risk (10,000 iterations). Sensitivity analysis was performed to evaluate the impact of uncertain input parameters on model results.

RESULTS AND DISCUSSION

Model calculations indicated that the average value of P_{carc} was 2.0×10^{-5} directly after final screening and 1.7×10^{-5} after a six-month waiting period. In the sensitivity analysis, the number of vaccinated (and tested) herds had a large influence on P_{carc} , where a larger vaccinated area reduced this probability. The model output was rather insensitive to changes in test sensitivities and prior distributions of P_A and P_H .

In conclusion, the additional waiting time did not importantly reduce P_{carc} . The calculated values are in fact worst case scenarios, because only viraemic pigs pose an infection risk, while seropositive pigs do not. The risk of exporting FMD via pig carcasses from a vaccinated area can further be reduced by heat treatment of pork and/or by excluding high risk pork products from export.

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