RATE OF INTER-HERD TRANSMISSION OF CLASSICAL SWINE FEVER VIRUS BY DIFFERENT TYPES OF CONTACT

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In large parts of the world epidemics of Classical Swine Fever (CSF) occur quite frequently. For the design of programs to quickly eliminate CSF virus (CSFV), quantitative knowledge of the transmission of the virus between herds is very helpful. For that reason, the most likely routes of virus introduction, and risk factors for virus introduction have been studied in the past. However, to optimise CSF control strategies quantitative information of the probability that the agent is transmitted given a contact between an infectious and susceptible herd would be helpful. In this study we estimated the rate at which CSF virus was transmitted by several different types of inter-herd contacts during the 1997-1998 CSF epidemic in the Netherlands.

Materials and methods

For each of the herds infected during the 1997-1998 CSF epidemic in The Netherlands we created a probability distribution of the week of CSFV introduction and subsequently the infectious period of the herds was established (1). Next, for each week in 1997 and the first 12 weeks of 1998, all contacts of each susceptible herd with an infectious herd were stored in a database. These contacts were subdivided into 1) shipment of live pigs (pigs), 2) pig transportation lorry that visited an infected herd earlier on the same day (lorry), 3) visitor and materials (lorry) 4) slurry (slurry) 5) semen from an infected AI centre (semen), 6) lorry that visited a possibly contaminated pig assembly point for welfare buying out earlier on the same day (assembly point), 7) lorry of the rendering plant (rendering), 8) lorry of the feed company that visited an infected herd earlier on the same day (feed), 9) infected herd within a radius of 500 meters (D0-500), 10) infected herd at a distance of 500-1000 meters (D500-1000), and 11) infected herd at a distance of 1000-2000 meters (D1000-2000).

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The data were analysed by use of a generalised linear model, using a log link function and a binomial distribution. The probability that a susceptible herd escaped from infection in a week (1 – probability of infection during that week) was the dependent variable in this model and the number of contacts of each of the different types in that same week were the explanatory variables. Variables with a type I error (α) larger than 0.1 were excluded from the model one at a time, starting with the variable with the highest α.

Results

The numbers of contacts between infected and susceptible herds that were traced are shown in Table 1. The contact types feed (p=0.48) and manure (p=0.51) were eliminated from the model in the stepwise backward elimination. The rates of transmission of the contact types included in the final model and their accompanying 95% confidence intervals are shown in Table 1. Even though the estimated rates of transmission of the contact types rendering and D1000-2000 were significantly larger than zero, the magnitude of these estimates in relation to the numbers of these contacts makes the contribution of these types of contact to the CSFV transmission negligible.

Table 1. Rate at which CSFV was transmitted from an infected to a susceptible herd by several different types of contact.

Contact type	Number of contacts observed	Rate of transmission	95% CI
Animals	172	0.0647 per contact	0.0043-0.1251
Lorry	3,123	0.0110 per contact	0.0014-0.0206
Visitor	2,468	0.0068 per contact	0.0007-0.0129
Buy out	1,876	0.0065 per contact	0.0000-0.0133
Semen	25,505	0.0007 per dose	0.0002-0.0012
Rendering	10,102	0.00002 per contact	0.00001-0.00003
D0-500	4,014	0.0270 per infectious herd per week	0.0176-0.0364
D500-1000	7,649	0.0078 per infectious herd per week	0.0037-0.0119
D1000-2000	18,375	0.00006 per infectious herd per week	0.00004-0.00008

NB: probability of transmission per contact = $1 - e^{-\lambda}$, in which λ is the rate of transmission.

Discussion

Although it has been long known that CSFV can be transmitted by the types of contact listed in Table 1, to our knowledge, this is the first study in which the rate at which the virus was transmitted by contacts of these types has been quantified. From the combination of these transmission rates, the rate at which these contacts occur and the number different herds that have contact, we can establish how much each different type of contact contributed to the overall inter-herd transmission of CSFV. This knowledge is helpful to design sets of measures that efficiently eliminate the virus.

Reference

1. Stegeman, JA, Elbers, ARW, Smak, JA., and De Jong, MCM. Quantification of the transmission of Classical Swine Fever Virus between herds during the 1997-1998 epidemic in the Netherlands. Prev Vet Med 1999; 42: 219-234.