How simulated disease epidemics risk classify pig farms in Finland?

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Introduction

The classification of production animal units by their ability to participate in further spread of an infectious disease is a relevant contingency issue. It may have a practical value in targeting preventive measures or assessing the risk of spread of infectious diseases in the country.

Materials and methods

Simulated trials for classical swine fever outbreaks

-stochastic simulation model
-outbreaks starting from each farm (n =3886), 128 iterations/farm

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Initial risk classification of farms

-2-step clustering by Z-transformed variables:
- probability for further spread
- expected number of infected farms on epidemic outbreaks

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Re-classification by ordinal regression model

-dependent variable: initial risk class
-explanatory variables:
- pigs on farm
- neighboring farms
- pig movements within 90 days

Results

The probability for further spread was four, and the expected number of infected farms was two times higher on farms of the very high risk class than on farms of the low risk class (Table 1).

The ordinal regression function classified farms fairly well, with a sensitivity and a specificity above 70% for every class (Figure 1).

***Table 1**. Risk classes of pig farms in Finland according to simulated trials for epidemic outbreaks, where each farm represented repeatedly the primary infected farm in the country.*

Variable		Risk class			
		low	medium	high	very high
Farms	n	1026	1312	1203	345
P_{eo}	mean	0.16	0.42	0.65	0.84
	range	0.02-0.33	0.07-0.66	0.30-0.90	0.13-0.99
E(N_{farms})	mean	2.8	3.1	3.7	5.2
	range	2.0-4.7	2.1-5.1	2.8-5.1	4.2-11.9

P_{eo}= Probability for further spread, E(N_{farms})= Expected number of infected farms during an epidemic outbreak

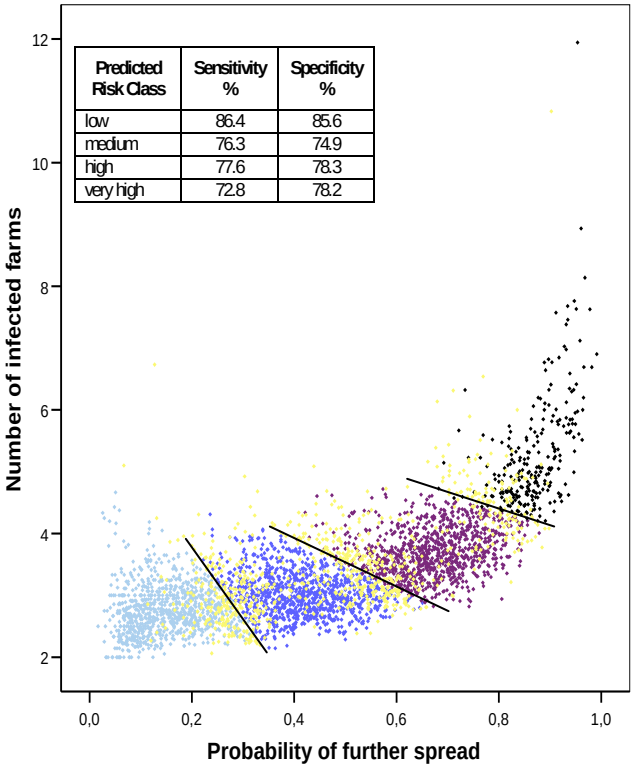

***Figure 1**. Clustering of farms on the basis of simulation of CSF outbreaks, clusters indicated by different colors, each dot is a farm, miss-classified farms are indicated in yellow. Black lines represent cut-off points defined by 2-step clustering.*

Conclusions

Ordinal function seems to be useful for general risk classification of production animal units when the magnitude of consequences is first estimated by other method. Since the current Finnish animal production farm population is constantly changing, ordinal regression function could easily be used to reassess the general risk level for disease spread in the country, and to identify pig farms with very high potentiality to promote further spread.