Using scenario tree modelling for targeted herd sampling to substantiate freedom from disease

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Key words
Targeted sampling, disease freedom, scenario tree model, IBR, EBL

Aim of the study
The aims of our study were to evaluate the performance and cost-effectiveness of a targeted sampling approach compared with conventional stratified random sampling using stochastic scenario tree modelling. Our study diseases for this task were IBR and EBL in Swiss cattle.

Material and methods
Relevant risk factors for the introduction of IBR and EBL into Swiss cattle farms were identified and their relative risks defined based on literature review and expert opinions. A quantitative model based on the scenario tree method by Martin et al. (2007) was subsequently used to calculate the required sample size of a targeted sample (TS) for a given sensitivity and to combine it with a baseline stratified random sample (bsRS), giving us a combined targeted and baseline stratified random sample (cTS&bsRS). An analysis of cost-effectiveness was conducted to compare the costs of the new risk-based approach with the costs of a conventional stratified random sample.

Results and significance
The required sample size to document freedom from IBR with sRS for a design prevalence of 0.2% and a required sensitivity of 99% is 2,259 farms. For EBL it is 2,243 farms. To obtain an overall sensitivity of 99% using cTS&bsRS, we combined bsRS with a sensitivity set at 90% and TS, for which we calculated a sensitivity of also 90%, on the 5%-percentile. The required sample sizes for IBR were 1,158 farms in the bsRS and 83 farms in the TS, resulting in a total of 1,241 farms for the combined approach of cTS&bsRS. For EBL, the sample sizes were 1,150 farms in the bsRS and 600 farms in the TS, resulting in a total of 1,750 farms for cTS&bsRS. Considering the additional administrative expenses required for the planning of TS, our approach was still more cost-effective than a sRS (40% reduction on the full survey costs for IBR and 8% for EBL), due to the considerable reduction in sample size. As the model depends on risk factors selected through literature review and was parameterised with values estimated by experts, it is subject to a degree of uncertainty. Nevertheless, this approach provides the veterinary authorities with a promising tool for future cost-effective sampling designs.

Publications, posters and presentations
Blickenstorfer, S.; Schwermer, H.; Engels, M.; Reist, M.; Hadorn, D. (2010) „Entwicklung und Evaluation eines Modells für die risikobasierte Betriebsauswahl zum Nachweis der Seuchenfreiheit". Oral presentation at the DVG conference in Leipzig.

Blickenstorfer, S. (2010) „Entwicklung und Evaluation eines Modells für die gezielte risikobasierte Betriebsauswahl zum Nachweis der Seuchenfreiheit". Doctoral thesis, Faculty of Veterinary Medecine, University of Berne.

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