

## Evaluation of the quality of case reporting data in Switzerland

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### Key words

Cattle trade, disease incidence, spatio-temporal disease mapping, underreporting

### Aim of the study

A major aim was to detect spatial and temporal patterns in the Swiss case reporting data and to assess factors for underreporting. A further key aspect was to quantify the impact of cattle trade on the spatio-temporal spread of an infectious disease. From a statistical, methodological point of view latent Gaussian models were introduced as a powerful class of models and Bayesian inference using integrated nested Laplace approximations was explored. A further issue was the choice of appropriate statistical model choice criteria.

### Material and methods

The analyzed data are spatio-temporal registry data provided by the Swiss Federal Veterinary Office, available from 1991. Furthermore, the number of traded cattle between pairs of Swiss regions is available for 2009. Factors influencing the case reporting were collected by a survey of the econcept AG in 2009.

### Results and significance

In addition to modelling spatial autocorrelation for constant, endemic risk, we describe the inclusion of a linear time trend for a case study on Coxiellosis in cows and discuss taking into account the number of stillborn calves as a region-specific covariate (linear, nonparametric). For an analysis of Salmonellosis cases in cows we propose a nonparametric time trend and discuss various modelling options. To analyze case reporting of Bovine Viral Diarrhoea concerning the affiliation of a region to a Swiss canton, we expand these models by a coarser, cantonal grid. A comparison with exclusively regional models using cross-validated scores shows a biased case reporting in several Swiss cantons. For Bluetongue cases (BT) in 2008/09 we perform a regression which assesses the association between individual information on vaccination, surveillance and altitude and the occurrence of BT for each farm. The results indicate that a vaccination reduces the risk of a BT infection. Using a vector-autoregressive model for multivariate time series, we show how information on networks between regions can directly be related to observed disease counts. Using this methodology, a spatio-temporal spread of Coxiellosis in cows between neighbouring regions and by cattle trade is detected by comparing one-step-ahead predictive scores. In a further, spatial analysis, factors influencing case reporting are assessed.

### Publications, posters and presentations

Willgert K, Schrödle B and Schwermer H (2011): Spatial analysis of Bluetongue cases and vaccination of Swiss cattle in 2008 and 2009. *Geospatial Health*, 5(2), 227-237.

Schrödle B and Held L (2011): A primer on disease mapping and ecological regression using INLA. *Computational Statistics*, 26(6), 241-258.

Schrödle B, Held L, Riebler A and Danuser J (2011): Using INLA for the evaluation of veterinary surveillance data from Switzerland: A case study. *Journal of the Royal Statistical Society, Series C*, 60 (2), 261-279.

Schrödle B, Held L and Rue H (2011): Assessing the impact of network data on the spatio-temporal spread of infectious diseases. Technical Report. University of Zurich. In revision for *Biometrics*.

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Held L, Schrödle B and Rue H (2010): Posterior and cross-validated predictive checks: A comparison of MCMC and INLA. In: *Statistical Modelling and Regression Structures - Festschrift in Honour of Ludwig Fahrmeir*. Springer, Heidelberg.

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