

Abstract

Spatial modelling of disease: methods and applications

Kims B. Stevens *

* **Corresponding author:** Veterinary Epidemiology and Public Health Group, Royal Veterinary College Hawkshead Lane, North Mymms, Hatfield, AL9 7TA, United Kingdom; **Tel:** +44-170-7666595, **Email:** kstevens@rvc.ac.uk

Objective: The purpose of spatial modelling in animal and public health is three-fold: describing existing spatial patterns of risk using techniques such as kernel smoothing (i.e. descriptive), attempting to understand biological mechanisms that lead to the occurrence of disease (i.e. explanatory) and attempting to predict what will happen in the medium to long-term future or in different geographical areas (i.e. predictive).

Background: Traditional methods for temporal and spatial predictions include, among others, general and generalized linear models (GLM) which comprise well-established algorithms and can effectively account for spatial dependence within the data. However, such models generally require both disease presence and absence points usually collected through observational studies which can be costly and, due to logistical constraints, may only cover a small geographical area.

Methodology: Yet spatial models are frequently required to cover large areas (e.g. Africa), and the only available inputs may be disease presence data obtained through surveillance or knowledge of the causal factors leading to disease occurrence.

However, there are modeling methods that require only disease presence data (e.g. ecological niche modeling) or those that require only knowledge of the disease's causal factors (e.g. multicriteria decision analysis). Such models relate the species distribution to their current environment through a range of predictor variables believed to limit the species distribution and are invaluable when disease data are scarce.

Conclusion: The results of such models can be used for a variety of purposes including targeting areas for surveillance, risk management, simulating different control scenarios or predicting what will happen under different environmental conditions such as those resulting from climate change (i.e. temporal prediction), or identifying new geographical areas suitable for the introduction of diseases (i.e. spatial prediction).

Key words: Application, disease, spatial modeling

Received: November, 2012

Published: December, 2012