Journal of Helminthology (2012) **86,** 386

Book Review

Models in the management of animal diseases

P. Willeberg (Editor). ***Revue Scientifique et Technique–Office International Des Epizooties*** **30,** 381–643.
World Organisation for Animal Health, Paris. 2011.
ISBN 978-92-9044-836-5

Models are frequently used in the management, prediction and control of animal diseases. The purpose of this special issue of the Scientific and Technical Review of the World Organisation for Animal Health, consisting of a number of papers written by modellers and experts in veterinary epidemiology, is to improve the understanding of the use of such models. This issue describes the different types of models used, and provides background into the development, verification and validation of models. There are many examples of the use of models in veterinary epidemiology, ranging from simple mathematical models to complicated simulation and network models.

Epidemiological models are important for understanding animal diseases, and animal diseases are important for epidemiological models. The first part of this statement is evident from the frequent use of models in the management of animal diseases. As to the second part, animal diseases have a special place in the field of theoretical epidemiology because they have provided data that are difficult to obtain for models based on human diseases. Examples include the development of epidemiological network models, which have greatly benefited from detailed data available on animal movement (see the paper by Dubé *et al.*; pp. 425–436), and the estimation of parameters based on experiments (see the paper by Hagenaars *et al.*; pp. 467–481), which is clearly difficult to do with human diseases.

A recurrent theme in this special issue is that of model validation, defined as the assessment whether or not a model is an acceptable presentation of the system it is supposed to describe (see the paper by Patyk *et al.*; pp. 547–554). Various contributions comment on how validation can be undertaken and emphasize the need for proper validation. This point, interestingly, is one where there is a clear need for further development. Whether or not one deems a model to be appropriate is ultimately a subjective decision, making the process of validation a difficult one to make operational. It is an area in which developments in statistics can provide some assistance. An essential observation is that many models are possible, and there is an inherent uncertainty whether a particular model is the best one possible. Even if one uses a single model, it is generally not possible to determine a value of the parameters with absolute certainty. Uncertainty is inherent in the use of models: there is no certainty that one has the right model, and there is no certainty that the parameters are right. There is, however, a positive side to this uncertainty in that it can be harnessed as a tool for model selection, as uncertainty can be quantified. This is the basis of methods based on statistical likelihoods. One can work out what the likelihood is, given a set of data, of a set of parameters, and this will also tell us how much credence we can attach to a certain choice of parameters. Once this uncertainty with respect to the parameters is quantified, one can proceed and, given a set of data, formulate the likelihood that a model is best in describing these data. This allows one to make a quantitative assessment of how good a model is, compared to others. From this it is obvious to ask if other models could be better in describing these data. This then leads naturally to a process of model selection which allows us to find the model that is best in describing the data in an objective manner (see Burnham & Anderson, 2002). Although one will still need to assess if a model is appropriate and acceptable, such methods could assist in this process by offering an objective methodology for relative validation.

Models in the management of animal diseases is a most useful introduction to those interested in the application of models to the study of animal diseases. The book provides a range of interesting applications, and leads for further research and applications.

Vincent A.A. Jansen
School of Biological Sciences,
Royal Holloway, University of London,
Egham TW20 0EX, UK
E-mail: Vincent.jansen@rhul.ac.uk

doi:10.1017/S0022149X12000272

Reference

Burnham, K.P. & Anderson, D.R. (2002) *Model selection and multimodel inference: A practical information-theoretic approach*. 2nd edn. New York, Springer.