

## Advanced Statistical Methods in Veterinary Epidemiology

### Overview

This module will provide an introduction to advanced methods of statistical modelling of epidemiological data.

Subject areas: analysis of spatial data; advanced aspects of multivariable regression analysis; analysis of correlated data; meta-analysis and systematic reviews.

(i) **Prerequisite**

Students must have passed the compulsory core module, Statistical Methods in Veterinary Epidemiology, prior to registering for this module.

(ii) **Software requirement**

You will require access to a computer with Microsoft Office and ArcGIS (version 8.0 or later) installed, and the extensions, Spatial Analyst and 3D Analyst. Please see the [Recommended System Requirements](#) for ArcGIS to ensure your computer meets the minimum hardware specifications. Whilst the GIS software required for this module is not compatible with Apple Macintosh computers, there are [workarounds](#) which allow the software to be installed on a Mac. The cost of the GIS software is not included in the course fee and you will need to purchase, if you do not have access already. For details of how to purchase the software:

- UK: Please contact the Course Administrator at [DLP@rvc.ac.uk](mailto:DLP@rvc.ac.uk), or
- Outside of the UK: Please contact [ESRI](#) and select your country of residence.

### Welcome to the course

Advanced Statistical Methods in Veterinary Epidemiology is an optional module in the Veterinary Epidemiology and Public Health programme of the Royal Veterinary College.

The module may also be studied as a 240-hour individual module.

## What will you learn from this course?

By the end of this course you should be able to:

- understand attributes of geographic data, georeferencing systems and the importance of spatial autocorrelation in spatial data analysis
- display a map within the GIS package ArcView and perform basic query operations and calculations
- plot point data using a GIS package and create a kernel density surface, based on plotted point data
- describe the structure of a fixed-effects model of disease count data and interpret the regression coefficients from a mixed-effects model
- select, apply and interpret the results of regression methods for the analysis of case–control and cohort studies, using appropriate computer software
- plan a strategy of analysis for an epidemiological data set, using an appropriate choice of methods and statistical models
- describe the effects of correlated data on epidemiological analysis, and the use of statistical methods which take account of such correlations
- review and summarize information from many studies using meta-analysis
- estimate the risk attributable to an exposure in a population.

Although this course has been designed to avoid unnecessary mathematical detail, a proper understanding of the methodology requires the use of some mathematical formulae. No knowledge of calculus will be required.

## Course structure

The course consists of 14 units of study, all of which you should complete. They make up the following three modules.

### Module 1: Investigation of Spatial Patterns of Animal Disease

In this module (Units 1–4) geographical information systems are introduced, based on the ESRI ArcView software, and computer-based activities will guide you through the process of producing maps from spatial data. You will learn how to undertake exploratory analyses and statistical modelling of spatial data, using DynESDA and the ESRI Spatial Analyst extension tools.

### Module 2: Advanced Methods of Statistical Analysis Part I

The second module (Units 5–8) is developed as Computer-Assisted Learning (CAL) material. The first unit of this module demonstrates how to review and summarize the framework and process of generalized linear regression models, using logistic regression as an illustration. Units 6 and 7 are about classical analysis of matched case–control studies. In Unit 8, different sampling schemes for case–control studies and the exposure odds ratio estimates are described.

## **Module 3: Advanced Methods of Statistical Analysis Part II**

The final module (Units 9–14) is also developed as CAL units. This module builds on the advanced statistical methods that were illustrated in Module 2. Unit 9 discusses the Poisson distribution, reviews Poisson regression and over-dispersion within a Poisson model. In Unit 10 you will learn about further issues for Cox regression and in Unit 11 about strategies for obtaining regression models that adequately describe the data. Unit 12 deals with how to conduct analyses of data based on correlated observations and Unit 13 introduces statistical approaches to meta-analysis and systematic review. The last unit focuses on attributable risk and on how to estimate the fraction of disease occurrence attributable to an exposure in a population.

### **Workbook for Modules 2 and 3**

In addition to the ten CAL units that make up Modules 2 and 3, there are seven practical computer sessions using the statistical package R. During these Workbook sessions, from time to time, you will review some of the material you have studied on the Statistical Methods in Veterinary Epidemiology course (SMVE). You are advised to work through the units and their associated sessions in the sequence in which they appear in the modules.

### **Study time**

The entire course, including revision and examination, is designed to take approximately 240 hours to complete. This is made up of approximately 80 hours' study time for Module 1; up to 40 hours for the CAL units of Modules 2 and 3 (allowing 3–4 hours for each of the ten units); roughly 20 hours for the Workbook practicals (allowing 2–3 hours for each of the seven practical sessions); approximately 20 hours for the TMA(s); and the remaining time for personal study and revision.

You may find that some units will take you more or less time than estimated, depending on your familiarity with the subject.

### **Tutor-marked assignments**

In addition to your work on the 14 units, you are required to complete and submit at least one tutor-marked assignment (TMA) for assessment. If you submit more than one – and you may submit up to two – your best TMA will be used in the calculation of your final mark. Full information on how to approach and submit TMAs is provided in the Programme Handbook and in the assignments themselves. You should bear in mind that your TMA will count for 20% of your final mark for the course.