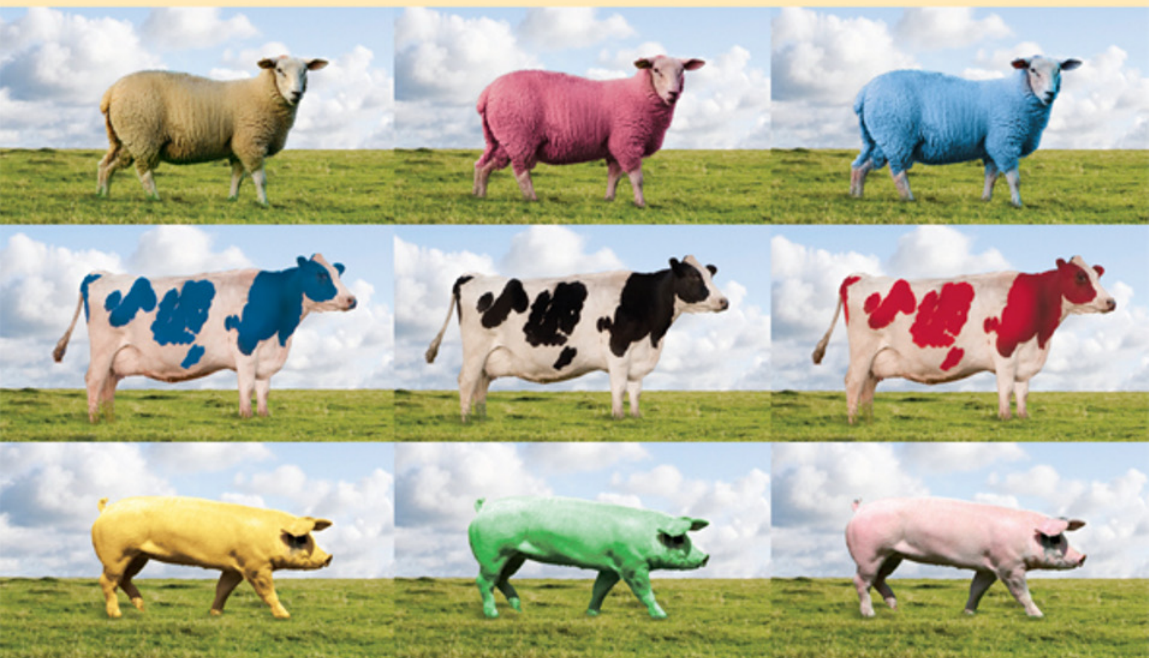


# Veterinary Epidemiology

## An Introduction

**Dirk Pfeiffer**



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To Susanne, Patrick and my parents.





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# Preface

The concept of epidemiology was introduced to me while I was conducting research for my postgraduate Dr.med.vet. thesis in Colombia in 1985, after completing my undergraduate veterinary studies in Germany. Today, veterinary epidemiology is integrated into the undergraduate veterinary course curricula in many countries around the world, recognising its contribution to generating and interpreting the scientific evidence supporting veterinary decision-making. Unfortunately, the vast majority of undergraduate veterinary students still do not recognise the need for a veterinary practitioner to be able to critically evaluate scientific research that informs their diagnostic and therapeutic decisions. Personally, I have found veterinary epidemiology a very exciting field to work in, and that is due to its integrative role between science and decision-making in relation to animal health. It is about collecting data related to real-world problems affecting animals and people, applying theoretical methods to this data for identification of the key relationships in underlying biological systems, and then using that generated knowledge to work towards solving the problems in collaboration with those affected. This basic approach allows veterinary epidemiologists to make contributions to animal and human health in almost any cultural and socio-economic setting around the world.

This book is based on a set of lecture notes which I originally wrote between 1992 and 1999 while teaching epidemiology to undergraduate veterinary students at Massey University, Palmerston North, New Zealand. During this time, the lecture notes were compiled into a book which was made available for free download through the Internet. That digital book has been translated into Thai, Serbian, Japanese and Spanish, and possibly other languages that I am not aware of. It was reviewed and challenged by the large number of postgraduate students that I have taught since 1992, as well as many

colleagues who used it around the world. Still, any errors in the previously available digital version and the current book are completely my responsibility. The current book replaces the digital book and is an almost complete rewrite of that version, taking into account new developments and changes in terminology.

The aim of this book is to provide a general introduction to veterinary epidemiology for anyone interested in the subject area, including undergraduate and postgraduate veterinary students, as well as animal health professionals involved in disease control at farm, national or international level. The book is deliberately kept short of detailed examples, so that it allows a quick introduction to most of the important concepts and methods. Suitable references are provided in the text to further information on specific topics, including other veterinary epidemiology textbooks such as the ones by Dohoo *et al.* (2009), Houe *et al.* (2004), Noordhuizen *et al.* (2001), Smith (2006) and Toma *et al.* (1999). The definitions and notation used in the current text are largely consistent with the textbooks by Rothman *et al.* (2008d) and Dohoo *et al.* (2009).

The content of the book is organised using a sequence of steps similar to what one might use during the planning and analysis of epidemiological investigations. Following the introductory chapter, Chapter 2 describes the general concepts of veterinary epidemiology with a particular emphasis on causation. Chapter 3 deals with various methods for quantifying disease risks and rates. Chapter 4 covers the topic of study design, leading on to Chapter 5 which introduces measures of effect. Issues of bias and statistical hypothesis testing are discussed in Chapter 6. Sampling of animal populations is fundamental to good study design and implementation, and this is dealt with in Chapter 7. An area where most veterinarians will have to deal directly with risk and uncertainty is diagnosis; Chapter 8 discusses methods that allow improved interpretation of diagnostic tests. Finally, Chapter 9 is a brief introduction to epidemiological concepts in the context of disease control and eradication.

I hope that this book will fulfil as useful a role as an accessible introductory reference to veterinary epidemiology as did the digital version that used to be freely available via the Internet.

Dirk Pfeiffer

# Acknowledgements

I have to thank Ewald Otte who explained the basic concepts of veterinary epidemiology to me in 1985 and then gave me the opportunity to gain practical experience in epidemiological research in his German technical cooperation project in Colombia in 1985. He also introduced me to Roger Morris who mentored me while I was studying with him for a PhD in New Zealand. After I completed my PhD, Roger gave me the opportunity to teach veterinary epidemiology at undergraduate and postgraduate level, resulting in the lecture notes which led to the development of this book.

I also have to thank my postgraduate students and colleagues as well as the participants of the many short courses I have had the privilege to have been involved in as a teacher around the world for reminding me that learning is a lifelong process. They continue to demonstrate to me that my knowledge even about basic epidemiological concepts will always be incomplete.

I also thank Suwicha Kasemsuwan and her colleagues at Kasetsart University in Bangkok who helped to make it possible for me to stay in Thailand so that I finally found the time to finish this book.

I would like to thank the members of our Veterinary Epidemiology and Public Health Group at the Royal Veterinary College for their patience during my five months' absence while writing this book. Katharina Stärk and Javier Guitian were very happy to cover several of my responsibilities while I was on sabbatical. Gilly Kyriacou adapted very quickly to my preference for electronic communication and provided efficient assistance.

I thank Justinia Wood from Wiley Blackwell who convinced me that I should publish this book; she demonstrated a lot of patience during the process. Katy Loftus very competently provided me with editorial support during the production process.

Finally, without my parents encouraging me to work overseas and take on challenges seemingly beyond my perception of my ability, I would never have become an epidemiologist. And I am most grateful to Susanne and Patrick who have always supported my professional ambitions and adventures and even came with me to Bangkok to support me while I was writing this book.

Dirk Pfeiffer