Preface and Acknowledgements to Second Edition

Since the appearance of the first edition of this book there has been a considerable development of interest in statistical methodology in the area of spatial epidemiology. This development has seen the increased output of research papers and books marking the maturity of certain areas of concern. For example, close to that date when the edited volume by Elliott *et al*. (2000) appeared, and since special issues of the *Journal of the Royal Statistical Society, Series A* (2001), *Environmental and Ecological Statistics* (2005), *Statistical Methods in Medical Research* (2005, 2006) and *Statistics in Medicine* (2006) have all contributed to the appearance of novel methodology. The development of software has also facilitated the wider use of the more advanced methods. In particular, the availability of free packages such as `R`, `WinBUGS` and `SaTScan` has led to wide dissemination of the available methods.

In particular, the area of disease map modelling has seen much development with Bayesian modelling as a particular feature. The use of mixture models and variants of likelihoods has seen development, while the routine application of sophisticated random-effect models is now relatively straightforward. The areas of disease clustering, ecological analysis and infectious disease modelling have all seen advances. In addition, the area of surveillance has re-emerged due to interest in early detection of potential bioterrorism attacks and in particular syndromic surveillance has become a major focus.

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Andrew Lawson, Columbia, South Carolina
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The development of statistical methods in spatial epidemiology has had a chequered career. One of the earliest examples of the analysis of geographical locations of disease in relation to a putative health hazard was John Snow's analysis of cholera cases in relation to the location of the Broad Street water pump in London (Snow, 1854). However, until recently, developments in statistical methods in this area have been sporadic. While medical geography developed in the 1960s (Howe, 1963), only a number of papers on space-time clustering (Mantel, 1967; Knox, 1964) appeared in the statistical literature. More recently, developments of methods in spatial statistics, image processing, and in particular Bayesian methods and computation, have seen parallel developments in methods for spatial epidemiology (see Marshall (1991b) for a review). It is notable that methods for the analysis of case locations around a source of hazard (such as Snow's cholera map) have only recently been developed (Diggle, 1989; Lawson, 1989). The current increased level of interest in statistical methods in spatial epidemiology is a reflection, in part, of the increased concern in society for environmental issues and their relation to the health of individuals. Hence, the 'detection' of pollution sources or sources of health hazard can be seen as the backdrop to many studies in environmental epidemiology (Diggle, 1993). The correct allocation of resources for health care in different areas by health services is also greatly enhanced by the development of statistical methods which allow more accurate depiction of 'true' disease incidence and its relation to explanatory variables. Previous work in this area has been reviewed by Lawson and Cressie (2000), and Marshall (1991b) and Elliott *et al*. (1992a) discuss the general epidemiological issues surrounding spatial epidemiological problems.

It is the purpose of this book to provide an overview of the main statistical methods currently available in the field of spatial epidemiology. Inevitably, some selectivity in choice of methods reviewed will be apparent, but it is hoped that our coverage will encompass the most important areas of development. One area which we do not examine in detail is that of space-time analysis of epidemiological data, although the modelling of infectious disease data is considered in Chapter 11.

As this book is mainly a review of recent research work, its target audience is largely confined to those with some statistical knowledge and is appropriate for

third level degree and postgraduate students in statistics, or epidemiology with a strong statistical background.

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Andrew B. Lawson, Aberdeen,
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