Essential Epidemiology

An Introduction for Students and Health Professionals

Second Edition

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Foreword

As a core discipline of public health, epidemiology provides a perspective and methodological approach relevant to all settings requiring rigorous evidence for health and wellbeing. Excellent introductory texts such as this are therefore invaluable to a range of audiences, including students and teachers, practitioners and researchers. The text leads the reader through the history, perspective, concepts and methods of epidemiology and some key public health applications, in a steady, clear fashion. It is nicely paced with worked examples, illustrative questions and tables and frequent practical asides. The style is easy, accessible and not at all dry, which will be particularly valuable for those whose first language is not English. Underlying this approachability, however, is a strong methodological rigour, reflecting the wide international research experience of the authors that informs their writing and teaching.

The second edition of this highly successful book is fully updated and includes expanded sections dealing with new terminology, current themes such as genetic epidemiology, life expectancy and global burden, and the importance of systematic reviews as a key public health tool for assessing causality and setting policy. It will be an excellent reader or background text for undergraduate and graduate students in epidemiology and public health.

Carol Brayne
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Preface

Preface to the first edition

This book has grown out of our collective experience of teaching introductory epidemiology both in the classroom and to distance students enrolled in public health and health studies programmes in the School of Population Health (formerly the Department of Social and Preventive Medicine), University of Queensland. It began life as a detailed set of course notes that we wrote because we could not find a single epidemiology text that covered all of the areas we felt were important in sufficient detail. As the notes were to be used primarily by distance students, we tried hard to make them accessible with lots of examples, minimal jargon and equations, and by engaging readers in 'doing' epidemiology along the way. Feedback from students and colleagues convinced us that the notes were both approachable and practical. We have built on this, and offer this text as a practical introduction to epidemiology for those who need an understanding of health data they meet in their everyday working lives, as well as for those who wish to pursue a career in epidemiology.

Acknowledgements

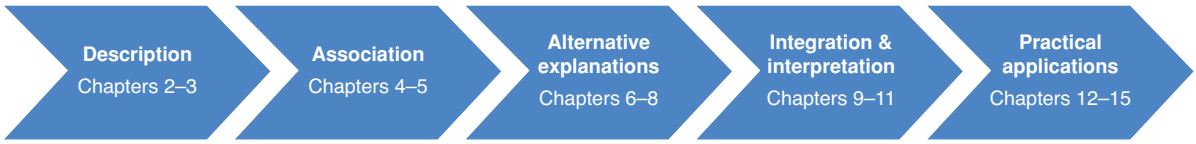
If we were to name everyone who had contributed in some way to this book the list would be endless. We would, however, like to acknowledge some of the great teachers (and their books) from whom we have learned most of what we know, and the books we have relied heavily on for our teaching. These include Brian MacMahon (*Epidemiology: Principles and Methods,* MacMahon and Pugh, 1970), Olli Miettinen, Charlie Hennekens (*Epidemiology in Medicine*, Hennekens and Buring, 1987), Ken Rothman (*Modern Epidemiology*, 1986), *Foundations of Epidemiology* (Lilienfeld and Lilienfeld, 1980), and *Epidemiology* (Gordis, 1996). We would also like to thank our colleagues and friends, especially the Fellows from the NHMRC Capacity Grant in Longitudinal Study Methods in the School of Population Health, University of Queensland, and the staff and students from the Cancer and Population Studies Group at the Queensland Institute of Medical

Research who willingly read drafts of the text and whose constructive feedback helped shape the final version. Particular thanks go to Adrian Sleigh (Australian National University) who authored Chapters 4 [Chapter 13 in the second edition] and 12 and also contributed to Chapter 15 [Chapter 16 in the second edition], Susan Jordan (QIMR) who helped with pulling everything together and Christine Howes (Bristol, UK) who drew all otherwise non-attributed illustrations. Finally, we would like to acknowledge the School of Population Health, University of Queensland, which provided the intellectual environment that led to this book as well as financial support to cover the costs of preparing the final draft.

Preface to the second edition

This first revision of our text reflects evolution, not revolution. We have listened to the feedback we have received from instructors and students and have tried to simplify and clarify some of the trickier bits of the original text while maintaining a very 'hands-on' approach. We have added new material to reflect contemporary epidemiological practice in public health and have re-ordered some of the existing elements to improve the flow and enhance the continuity between chapters. New and expanded topics include a look at how we measure the burden of disease, greater discussion of issues relevant to ethics and privacy, and appendices covering life tables and calculation of confidence intervals for common epidemiological measures. We have also added a glossary and developed an accompanying website with useful materials including additional test questions and answers, resources for teachers and useful links to a variety of web-based data sources and other epidemiological sites. The website can be accessed at www.cambridge.org/webb.

Our overall aims are, however, unchanged – to show the role of epidemiology across a broad range of health monitoring and research activities and to give students a good understanding of the fundamental principles common to all areas of epidemiology including the study of both infectious and chronic diseases as well as public health and clinical epidemiology. To this end, we have maintained the general structure of the original text. As previously, Chapter 1 is a general introduction that both answers the question 'what is epidemiology and what can it do?' and presents the main concepts that are the focus of the rest of the book.



The first sections cover the basic principles and underlying theory of epidemiology in a very 'hands-on' way.

We start by looking at how we can measure disease and, new to this edition, the overall burden of disease in a population (Chapter 2), followed by a look at the role of descriptive epidemiology in describing health patterns (Chapter 3). We move on to look at the types of study that we use to identify potential causes of disease including an expanded discussion of the potential of record linkage (Chapter 4) and how we quantify the associations between cause and outcome (Chapter 5). In response to feedback from the first edition, we then present a separate look at the role of chance in epidemiology (Chapter 6), a simplified discussion of the thorny issue of error and bias (Chapter 7) and a practical overview of the problem of confounding (Chapter 8). This leads to the next section where we integrate this information in a practical look at how we read and interpret epidemiological reports (Chapter 9), think about assessing causality (Chapter 10) and finally synthesise a mass of information in a single review (Chapter 11). In the final section we look at some specific applications of epidemiology including the study of outbreaks (Chapter 12), surveillance (Chapter 13), prevention – including an expanded discussion of how we can assess the impact of different preventive interventions on the health of a population (Chapter 14), and screening (Chapter 15), while Chapter 16 concludes with a fresh look at what epidemiology is and what it can do to help address the health concerns facing the world today.

Symbols

Throughout the book we have used **bold** typeface to indicate terms included in the glossary and the following symbols are used to define key elements within the text.

We strongly believe that the best way to learn anything is by actually doing it and so have included questions within the text for those who like to test their understanding as they go. Because we also know how frustrating it is to have to search for answers, we have provided these immediately following the questions for those in a hurry to proceed.

We have used numerous real-life examples from all around the world to illustrate the key points and to provide additional insights in some areas. Extra examples that provide added interest and complement the main message in the text are given in boxes featuring this symbol.

Many books present clinical epidemiology as a separate discipline from public health epidemiology – a distinction that is strengthened by the fact that clinical epidemiologists have developed their own names for many standard

epidemiological terms. In practice all epidemiology is based on the same underlying principles, so we have integrated the two approaches throughout the book but have also highlighted specific examples more relevant to the clinical situation. (Please note that this book does not offer a comprehensive coverage of clinical epidemiology; rather we aim to show the similarity of the two areas where they overlap.)

We have deliberately tried to keep the main text free of unnecessary detail and equations but have included some epidemiological 'extras'. This material is not essential to the continuity of the core text but provides some additional information for those who like to see where things have come from or want a more detailed perspective.

Acknowledgements for the second edition

We are again indebted to the many people who have provided input at all stages of the development of this book. In addition to those named previously, a few deserve a special mention. Our former colleague and co-author of the first edition, Sandi Pirozzo, has moved on to a rewarding new career post-epidemiology; we remain grateful for her prior contributions and for her continuing friendship and interest. Adrian Sleigh has kindly updated the chapter on Outbreaks that he wrote for the first edition and has also contributed valuable insights to the chapter on Surveillance and the final chapter. Discernible improvements in the cohesion and internal 'sign-posting' of the book reflect excellent critiques and suggestions we received from Michael O'Brien and Kate Van Dooren, the former an educator and the latter a doctoral student within the School of Population Health. Kate also provided much practical support which enabled this revision. Finally, our expanded consideration of the 'Burden of Disease' approach has benefited from interactions with, and teaching materials developed by members of the Burden of Disease group at the School of Population Health, especially Theo Voss, Steven Begg and Alan Lopez. Finally we thank the many users of the first edition, particularly the team from Otago University in New Zealand, who provided the critical feedback that has directly led to this new and hopefully improved edition.