EPIDEMIOLOGY

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Preface

Epidemiology is a fairly young discipline which is highlighted by the fact that the first ever epidemiology textbook, written by Brian MacMahon and Thomas Pugh, was published just about 50 years ago in 1960. The core business of 'classical epidemiology' was, and still is, the identification of occurences and distributions of diseases in populations and the detection and evaluation of causes of diseases. However, epidemiology has been a very dynamic discipline with new focus areas being added constantly—molecular, social, spatial, and cognitive epidemiology are just a few examples of more recent specialisations.

In the early 2000s some geneticists predicted the end of epidemiology as we know it, suggesting that genetics would soon be proven as the ultimate cause for most if not all diseases. This rather simplistic view may still be hampering serious genetics research but in the meantime genetic epidemiology, assessing the interplay between environmental and genetic factors and their role for health events, is thriving.

WHY ANOTHER EPIDEMIOLOGY BOOK?

Epidemiology belongs to the health sciences and medical scientists have traditionally dominated the discipline, bringing a disease centred approach to epidemiology. Our backgrounds, however, are in general research methodology, including biostatistics, and we hope to be able to contribute with our book a somewhat different point of view to further promote and progress modern epidemiology towards its full potential: a methodologically well grounded and versatile tool-kit to conduct evidence-based research in all health sciences.

This 'methods based' approach finds its expression already in the overall structure of this introductory level book that follows the logic of the epidemiological research 'cycle', which is probably better described as an upward spiral in the sense that each research study contributes novel evidence to the knowledge base of the respective discipline. We hope that this structure and our methods based approach as well as the plethora of examples from a broad spectrum of health related disciplines render this textbook to be a practical guide for conducting quantitative research in the broad field of the health sciences.

We surely advocate the integration of qualitative and quantitative research designs. However, in this book we focus only on quantitative research methods since qualitative

methods have become a very large discipline in its own right, including such varied concepts and techniques that only a separate book could do it justice.

This introductory textbook to epidemiology is largely based on our lecture notes for both postgraduate students of epidemiology for public health, and under-graduate students of public health and other health sciences (including medicine, nursing, physiotherapy, sports and exercise sciences, and occupational therapy). As with our lecture notes, we have opted for a two-level approach differentiating between 'introductory' knowledge that all students of epidemiology should be familiar with and 'beyond the basics' information for the interested or more advanced reader. The levels of the different sections are indicated in an overview table starting on page xxvi.

The first four chapters of the book introduce the reader to epidemiology, its historical roots and some basic concepts. The remaining chapters 5 to 14 follow the logic of the epidemiological research spiral.

Chapter 5 clarifies the concepts of a literature review, the first step of every epidemiological research study. This is followed by the formulation of an operational research hypothesis, a complete and quantitative precise statement of the question the research will aim to confirm or reject. Since the study design and the development of the research hypothesis are closely interlinked, different types of studies, their applications, advantages and disadvantages are subsequently discussed in some detail in Chapters 6, 7, and 8.

Chapter 9 discusses 'bias', systematic error in the conduct of epidemiological studies, and how bias can be avoided or at least controlled to achieve valid conclusions. Chapter 10 introduces basic sampling strategies and sample size considerations necessary to achieve an 'optimal' sample size for a planned study.

The logically following steps in the research spiral are then to develop measurement tools, such as questionnaires, collecting the data, entering the collected information into a data base (Chapter 11), and analysing the data statistically in order to reject or confirm the stated research hypothesis (Chapter 12). The chapter on statistical analyses is kept very concise and in non-technical language where possible; it is not intended to be a text for general statistical analysis but an introduction to the main concepts and techniques relevant in statistical hypothesis testing.

Chapter 13 deals with the important issues of ethics in human research. Finally, to achieve an 'upward' momentum in the research spiral, the results have to be published (Chapter 14) to be accessible to other scientists and to contribute novel evidence to the area-specific knowledge base.

Each chapter is accompanied by numerous critical thinking exercises (some conceptual, but more often practical also necessitating some calculations) with answers given in the back of the chapter.

The glossary at the end of the book provides an abridged 'dictionary' for epidemiology. However, the definitions provided there are working definitions as introduced and used in the context of this book; they may not be universally acceptable to all epidemiologists.

Throughout the book we apply examples of recent epidemiological research conducted in Australia and New Zealand. These examples are drawn from a wide range of disciplines demonstrating that epidemiological methodologies are essential research tools across the health sciences. We aimed at presenting as much original research as possible, though sometimes the actual figures had to be adjusted for ease of calculations or other pedagogical purposes. We hope that the examples showcase ongoing research in Australia and New Zealand and provide some inspiration to students of epidemiology.

Students sometimes may perceive epidemiology as a daunting subject. We thus aimed at introducing the concepts structured and in non-technical terms whenever possible and provided ample examples and exercises to stimulate reflection on theoretical concepts as well as on practical issues. However, every textbook has its limits—to really appreciate epidemiology you will have to jump into the deep end and conduct epidemiological research yourself. Our aim was to inspire readers to do exactly that!

Acknowledgments

Naturally this textbook would not have been written without the support of many people. First and foremost we would like to thank our friend and mentor at the Free University in Berlin, Germany, the late Professor Irene Guggenmoos-Holzmann (1948–1997). We would like to thank also in particular all our epidemiology students who helped us improve our lecture notes over the last decades. We gratefully acknowledge the contributions of Robert MacLennan, Professor Emeritus of Epidemiology, Queensland Institute of Medical Research, to an earlier version of our lecture notes. We also thank numerous friends and colleagues who supported and informed this book project over the last two years.

We would like to express our gratitude to Dr Madeleine Nowak and Dr Clive Wilkinson who helped us tirelessly in reviewing a first version of the manuscript and to all our colleagues who were happy enough to showcase their research in our book and to confide to us some of the intricacies of their epidemiological research.

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