Preface to the Second Edition

Epidemiology is a fascinating and lively subject, but studying it is too often excessively abstract and fraught with existential concerns. Although some of these abstractions and concerns are necessary—indeed essential—I have tried to bring out the liveliness of the subject by frequent use of *real and tangible examples from contemporary and historically important epidemiologic studies*. The object of this approach is to promote interest in epidemiology as a subject in its own right by emphasizing its fundamental ideas and the principles and criteria involved in applying them while keeping at least some of the technical details from dominating the scene. It is my hope that by working backwards, from tangible examples to abstract reasoning, a deeper appreciation of numerical as well as philosophical principles will be gained.

Epidemiological reasoning, like any form of reasoning, is essentially independent of its content. Nevertheless, *illustrations* of content are indispensable for the beginner, both as a motivation and as a means of learning. Of equal importance is an understanding of the historical context in which each type of reasoning developed. It is for these reasons I have chosen to use historical examples as an essential means of illustrating numerical epidemiologic principles. Examples from the 17th to the 20th century concerning such diverse topics as life expectancy, smallpox vaccination, cholera outbreaks, pellagra epidemics, cardiovascular disease risk factors, and of course smoking and health are included in this text, often cited from the original research, and often used in the context of the method developed or incited.

It is not possible to teach a student in an introductory course all he or she is likely to need to know about epidemiology. And it is not expected that an instructor in an introductory epidemiology course will attempt to address such *coverage*. To some extent, the question is one of depth versus breadth. This textbook writer faced a similar dilemma. Do I write deeply on a small, well-focused element of the field or do I provide a generalist's approach? My approach in this book leans toward that of the comprehensive—epidemiology is a broad topic. I believe in the Talmudic principle that one needs to be a generalist before becoming a specialist. However, I am a realistic in my expectations. Therefore, an instructor in an introductory course should not attempt to cover all of the material presented. Selective use of

topics relevant to the course and the instructor's interests is recommended. Thus, I have tried to emphasize certain principles, ideas, criteria, and methods throughout the book, in a general way, in whatever context they may be encountered. The idea of "addressing the full extent of evidence," for instance, and not just selected elements, is emphasized in the context of the infectious disease process, screening for disease, engaging in the statistical inference, determining causality, and so on. "Methods" of integrating knowledge and the commonsense application of judgment are emphasized throughout.

Another area that seems of necessary concern is the adoption of *notational consistency.* This issue is particularly problematic since epidemiologic and biostatistical notation are far from uniform. To some extent, notational preferences of epidemiologists depend on their parental discipline (e.g., medicine, biostatistics, social science) and the age of the epidemiologists (e.g., those of us "weaned" in the early 1980s often prefer the explicit notation of Kleinbaum et al. (1982), while newer breeds may prefer the advanced notation of Rothman and Greenland (1998). There are geographical differences in preference as well. In this edition of the book, I have adopted, when possible, typical biostatistical notation, denoting population parameters by Greek letters and estimates from samples with overhead "hats." This approach is adopted to help students make the necessary connection to the principles they learn in their introductory biostatistics course with those they learn in epidemiology. (Complete notational consistency is impossible, both because of the lack of one standard and of irreconcilable ambiguities in any given notational system.) A table of notational conventions is included in the front of the book.

Another new feature of this edition is frequent use of *epidemiologic calculators*, notably the public domain Windows programs *WinPepi* (Abramson & Gahlinger, 2001) and *EpiCalc2000* (Gilman & Myatt, 1998). These programs will relieve students from some of the tedium and anxiety of hand calculation, while opening up possibilities of using some advanced techniques that might not otherwise be possible. It is time to familiarize even introductory students to these essential tools of the trade. Their use is intended to give students more complete appreciation of numerical principles, and not subvert the need to work through problems. Hand calculations are encouraged, especially for computationally less intensive techniques, with checking of results with an epidemiologic calculator as a second step.

The claim of *simplicity* in the title may seem pretentious to practicing and theoretical epidemiologists and perplexing to students of epidemiology. Perhaps it is true that a topic as complex and encompassing as "the study of the distribution and determinants of disease in populations" cannot be made simple, at least not in the sense of being "easy." And perhaps it cannot be simplified or distilled to just a few basic principles. The term *simple* as used here, however, refers to neither "easy" nor "distilled." What I am seeking in terms of simplicity is not quite so ambitious. The object of the simplicity sought is to *begin from scratch*—to begin at the beginning. This view is in no way innovative. I write nothing that people did not know before. Good epidemiology comes from attentive observation, accurate counting, clear reasoning, quality data, well-founded theories of mechanisms, and a willingness to change one's view when faced with contradictory evidence. No magic "methodology" is presented.

The claim in the subtitle of being an introduction to both old methods and new is admittedly nebulous and ambiguous, and I am not willing to press the issue. The terms *traditional epidemiology* and *modern epidemiology* bring with them the baggage of a discipline seen by some as experiencing growing pains (Susser, 1989; Susser & Susser, 1996; Winkelstein, 1996; 2000) or perhaps even reaching its limits (Taubes, 1995). However, in

using the terms *traditional* and *modern*, I had in mind a number of different interpretations: that epidemiology has matured from its 19th-century roots as a discipline concerned with the control of contagion and explosive outbreaks to an expanded scope that includes the study of noninfectious causes of illness, injury, and disability; that epidemiology has expanded its scope from single-agent cause to multi-causality, in which the effect of a cause is seen relative to every other cause; that epidemiology's traditional person, place, and time cross sections have been supplemented with the study of people's experience over time to determine when health fails in relation to putative determinants of health. The traditional/modern dichotomy is not meant to represent an either/or situation. In fact, like others before me (Barrett-Connor, 1979; Stallones, 1980), I take it as a matter of faith that there is only *one epidemiology*.

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Preface to the First Edition

Things should be made as simple as possible, but not any simpler
—Albert Einstein

WHO STUDIES EPIDEMIOLOGY AND WHY THEY BOTHER

What is Epidemiology?

Epidemiology studies the causes, transmission, incidence, and prevalence of health and disease in human populations. Medical and public health disciplines use epidemiologic study results to solve and control human health problems.

Who Studies Epidemiology?

Traditionally, epidemiology has been studied as the core science of public health. As such, it provided the objective basis for disease prevention and health promotion. Public health professionals of all types must communicate risk and read epidemiologic information. Epidemiology provides the tools to evaluate health problems and policies on a population basis. Epidemiology is also included in many undergraduate and graduate programs in medicine, the allied health professions, community health, environmental health, occupational health and industrial hygiene, health education, and health services administration. Because of its power and utility, epidemiology continues to gain a still wider audience.

Epidemiology as a Liberal Art

The study of epidemiology also belongs in the liberal arts. A liberal arts education provides general knowledge and develops overall intellectual capacities. Epidemiology fits nicely into an undergraduate liberal arts course of study because (Fraser, 1987):

- It uses the scientific method.
- It develops and improves one's ability to reason inductively (reasoning from the specific to the general).
- It develops and improves one's ability to reason deductively (logical conclusion that follows from a premise).
- It develops and improves one's ability to reason by analogy.
- It develops one's concern for aesthetic values (appreciation of elegance, beauty, simplicity, grace).
- It emphasizes investigative method rather than arcane knowledge and specialized investigative tools.

Moreover, epidemiologists benefit from studying the humanities. By studying the humanities, epidemiologists learn who they are, what is right, and how to think and act. Studying the humanities encourages epidemiologists to focus their skills on the people they serve while increasing flexibility of perspective, encouraging nondogmatisms, improving critical thinking skills, and promoting a better balance of values and ethics (Weed, 1995).

Other Reasons to Study Epidemiology

There are still other reasons to study epidemiology. One such reason is to better understand the mounting epidemiologic information we receive on a regular basis. Much of this information is confusing and some of it is apparently contradictory. To effectively use epidemiologic information, we must understand its basis, its strengths, and its limitations. Without understanding the basis of epidemiologic research, we cannot make informed health decisions for ourselves and others.

Moreover, as involved citizens and voters, we often need to evaluate potential risks and benefits of public and private interventions and policies. For example, we may be called upon to vote on regulations to allow the construction of an industrial facility in our community. To make an informed decision, we must compare the potential economic benefits of the development to the potential environmental hazards it might present. Issues like this respond to epidemiologic analysis by preparing us to weigh the risks and benefits of an intervention on a population basis.

Finally, today's job market seeks people with epidemiologic competencies, such as those associated with data collection, risk/benefit analysis, survey methodology, and outcomes evaluation. These epidemiologic job skills might be useful in your current job and are transferable to other jobs as well.

And, yes, there is another reason to study epidemiology: it is inherently interesting. The challenges of disease detectives have captured the public's interest, as I hope this book will capture yours.

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