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# Editorials, Annotations, and Comments

## Editorial: Eras, Paradigms, and the Future of Epidemiology

In their provocative articles in this issue of the Journal, Susser and Susser and Pearce discuss the evolution of epidemiology over the past 2 centuries and plead for broader paradigms for its practice and role in public health and society.<sup>1-3</sup> However, this is not a new theme. In the preface to the first textbook of epidemiology, Major Greenwood's *Epidemics and Crowd-Diseases*, published in 1935, the author indicates his intent to influence, "a wider circle of readers than present or future members of the public health services, viz. *all* (italics in the original) educated men and women interested in the communal aspects of health and disease."<sup>4</sup> He later defines epidemiology and its perspective as "the study of disease, any disease, as a mass phenomenon. . . . The epidemiologist's unit of study is not a single human being but an aggregate of human beings, and since it is impossible to hold in the mind distinctly [sic] a mass of separate particulars he forms a general picture, an average of what is happening, and works upon that." Greenwood's apt title and pithy comments seem to reflect 19th-century utilitarianism and post-World War I pragmatism.

The Sussers' characterization of epidemiologic eras and paradigms is not inconsistent with this interpretation. Their eras and accompanying paradigms are designated *sanitary statistics* (first half of the 19th century) with its paradigm "Miasma: poisoning by foul emanations from soil, air, and water"; *infectious diseases* (late 19th century through first half of 20th century) with its paradigm the "Germ theory: single agents relate one to one to specific diseases"; and *chronic diseases epidemiology* (latter half of 20th century) with its paradigm the "Black box:

exposure related to outcome, without necessity for intervening factors or pathogenesis." They then predict a new era, soon to begin if not already here, which they designate, *eco-epidemiology*, with its paradigm, *Chinese boxes*. By *eco-epidemiology*, the Sussers mean the study of "causal pathways at the societal level and with pathogenesis and causality at the molecular level." To implement *eco-epidemiology*, they see the necessity for a new paradigm involving the integration of a series of interactive research strategies, or systems, each directed toward some aspect of the complex relations of disease to society and the individual; hence, the label *Chinese boxes*.

In a related vein, Pearce documents a growing concern that modern epidemiology, with its emphasis on methodology and risk factor identification in the individual, has diverted epidemiologists from a primary concern in understanding the dynamics of disease occurrence in populations. One of the important consequences of these phenomena, according to Pearce, is the alienation of epidemiology from public health practice. He strongly advocates the reintegration of a population-oriented epidemiology into public health.

Although few readers of a journal devoted to issues of public health would argue with the relevance of the Sussers' and Pearce's papers, it might be helpful to examine them from a somewhat different perspective. First, consider the concept of eras. Clearly, eras overlap with one another. For example, did the infectious disease era begin with Fracastorius in the 16th century, or with Jenner in the 18th

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**Editor's Note.** See related articles by Susser and Susser (p 668 and p 674) and Pearce (p 678) in this issue.

century, or with Henle and Snow in the 1840s and 1850s, or with Pasteur and Koch in the 1870s and 1880s? Or, did the chronic disease era begin with Baker's study of lead poisoning in the 1760s, or Lane-Clayton's study of breast cancer in the 1920s, or with the studies of lung cancer in the 1950s? Incidentally, did the infectious disease era end in the middle of the 20th century or did it achieve its most important successes with the field trials of poliomyelitis vaccines, the eradication of smallpox, and the elucidation of the epidemiology of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) in the 1950s, 1970s, and 1980s, respectively? And the era of eco-epidemiology, was it not initiated by Goldberger's studies of pellagra, beginning with field epidemiological studies of nutrition and social conditions as risk factors in the years following 1914 and continuing into the 1920s with efforts in the laboratory to identify the specific nutritional agent, the absence of which was responsible for the specific pathology? Delineating "eras" is certainly a useful organizing concept, but it is likely to be an oversimplification of reality.

Similarly, consider the issue of paradigms. During the 19th century, the period encompassing the era designated by the Sussers as the Sanitary Era, the miasmatic paradigm competed continuously with the contagion paradigm. In fact, even after the contagion paradigm was definitively affirmed by the isolation of infectious bacteria in the 1880s and the establishment of the germ theory, miasmaticists like Max von Pettenkofer advocated the paradigm into the early years of the 20th century.

With respect to the black box paradigm for the era designated *chronic disease epidemiology*, many epidemiologists would argue that the dominant epidemiological paradigm was multifactorial causation as represented by the web

of causation concept. Furthermore, it is questionable whether epidemiologists, after World War II, really subscribed to a paradigm characterized by "exposure related to outcome, without necessity for intervening factors or pathogenesis." This is most clearly demonstrated in the 1964 report, *Smoking and Health*, in which epidemiology is intimately interwoven with economics, chemistry, pathology, pharmacology, toxicology, sociology, and psychology to establish the causal role of smoking for several major diseases.<sup>5</sup> Furthermore, few documents have been more influential in altering population exposure to a major disease risk factor. Thus, one might assert that *Smoking and Health* epitomizes the paradigm of the Chinese boxes proposed by the Sussers and provides a model for the integration of epidemiology into public health as advocated by Pearce.

So, are we entering a new era of epidemiology requiring a new paradigm as proposed by the Sussers? Certainly, times are a-changing, and there is a need to incorporate innovative approaches to the study of health and disease in populations. It is critically important to consider such innovations, as we are doing in this issue of the Journal. However, I would argue that the innovations proposed represent the evolution of concepts and methods that have been continuously changing for a very long time, indeed. There is no doubt that the practice of epidemiology will be profoundly affected by these innovations. However, we should not forget that Sir George Baker collaborated with a London chemist in 1767 to demonstrate that Devonshire cider produced in lead-lined presses was adulterated with a disease-causing agent, or that in 1854, John Snow collected and analyzed data from 1361 cases of cholera to establish the role of sewage-contaminated water in the propagation of the epidemic. Molecular biology will certainly augment

the epidemiologist's capability to study disease causation, and modern computer-based information transfer technology will extend the ability to access and process large bodies of data, but it is arguable whether this sophistication represents the alteration of underlying paradigms.

There is ample evidence to support Pearce's thesis that the so-called modern epidemiology has been overly concerned with methodology, has emphasized a reductionist approach, and has downplayed a population orientation. This has been particularly true of the epidemiology practiced in academic settings. Nevertheless, epidemiology still plays an important role in organized public health agencies, as demonstrated weekly in the *Morbidity and Mortality Weekly Report* of the Centers for Disease Control and Prevention. Because epidemiologists are being trained primarily in academic programs, I would suggest that Pearce's plea for the integration of epidemiology with public health be directed particularly to those venues. □

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## Editorial: The Promise of Risk-Based Allocation Trials in Assessing New Treatments

When it seems impossible to mount a randomized trial of a treatment or when its implementation seems likely to be unsatisfactory, for whatever reason, what can investigators do to assess the effect of the proposed treatment? Sometimes the ethical problems in a situation preclude a

trial, and sometimes the mood of the relevant population—unwillingness to participate in a trial—would prevent its proper execution.

In this issue of the Journal, a paper in two parts, including a substantial appendix (really a third paper), by Finkelstein et

al. address this kind of question in a variety of ways.<sup>1,2</sup> Although the authors use examples to illustrate applications oriented toward the clinical setting in

**Editor's Note.** See related articles by Finkelstein et al. (p 691 and p 696) in this issue.