ASPECTS OF THE
HISTORY OF EPIDEMIOLOGY

TIMES, PLACES, AND PERSONS

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Times, Places, and Persons

The Henry E. Sigerist Supplements to the
Bulletin of the History of Medicine
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Editor: Lloyd G. Stevenson, M.D.

Henry E. Sigerist, recruited by William H. Welch to be director of the Johns Hopkins Institute of the History of Medicine, was the founder of the *Bulletin of the History of Medicine* and also of the first series of supplements, which extended from 1943 to 1951. It was Sigerist's resolve that the *Bulletin* should provide the organ not only of the Johns Hopkins Institute but also the American Association, and to this day it subserves both functions. It is therefore eminently suitable that the new series should bear the founder's name and perpetuate his scholarly interests. These interests were so broad and so varied that the supplements will recognize no narrow limits in range of theme and will publish historical essays of greater scope than the *Bulletin* itself can accommodate. It is not too much to hope that in time the Sigerist supplements will help to extend the purview of medical history.

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A Conference on the History of Epidemiology
Sponsored by
The Josiah Macy, Jr. Foundation
and
The Johns Hopkins University
Institute of the History of Medicine and
School of Hygiene and Public Health
May 5, 1978

Preface

The marked growth of epidemiology as a scientific discipline is evident in its widening scope of application to the entire range of public health and medical problems. Paralleling this growth, epidemiology has also matured in its methodologic and inferential content. A sign of such maturation is the increased interest in the historical background and development of epidemiology by its practitioners as well as its historians. Thus, the time was ripe for organizing this Conference on the History of Epidemiology which was presented on May 5, 1978, by The Johns Hopkins University, Institute of the History of Medicine and School of Hygiene and Public Health, with the generous support of the Josiah Macy, Jr. Foundation.

In planning the Conference, it was recognized that the perceptions of historians and of epidemiologists do differ. The historian takes into consideration the total historical context within which a discipline develops, whereas the epidemiologist is usually more concerned with its internal conceptual changes. Consequently, it was considered desirable to intermesh these two aspects to the largest extent possible. In an attempt to achieve this objective, it was arranged to have a historian discuss an epidemiologist's presentation and conversely to have an epidemiologist discuss a historian's presentation. In addition, the president of each of the professional organizations of these two disciplines, the American Epidemiological Society and the American Association for the History of Medicine, chaired the morning and afternoon sessions, respectively.

Modern epidemiology essentially originated in the beginning of the nineteenth century with William Farr as one of its leaders and with the French hygienic movement playing a major role; the conceptual origins and contributions of Farr are discussed by Eyler and that of the hygienic movement by the Lilienfelds. Today, close relationships exist between the fields of statistics and epidemiology. This was historically always true, as shown by Hilts's review of the statistical movement of the nineteenth century and its relationship to epidemiologic thinking.

After this general background is painted on the historical canvas, more specific areas are reviewed, with Roe first summarizing the various attempts at eradicating pellagra. This is followed by a consideration of infectious diseases, where epidemiology has made major contributions to their understanding and control. First, Richmond reviews the conceptual history of the germ theory of disease. Then Henderson's presentation of the history of the eradication of smallpox brings us to the contemporary scene. Finally Woodward discusses yellow fever, a disease yet to be conquered.

The formal discussions of each of these presentations are included in this volume. With these, new issues and questions are raised, clearly indicating that the Conference represents only the beginning of this historical quest.

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The Conceptual Origins of William Farr's Epidemiology: Numerical Methods and Social Thought in the 1830s

John M. Eyler

British and American epidemiologists looking for the historical roots of their discipline have assigned unusual importance to William Farr. According to Sir Arthur Newsholme, "Farr must be ranked with William Harvey in Physiology or with Lavoisier in chemistry . . . [He] was a chief architect of the public health administration, which during his life-time was built up chiefly by three men, Edwin Chadwick, John Simon, and Farr himself."[1] Writing nearly a quarter-century later, Major Greenwood expressed similar views. The methods of using vital data which Farr introduced were "the most valuable single instrument of social-medical research our national armoury contains."[2] More recently Alexander Langmuir and the Lilienfelds have written enthusiastic appreciations of Farr's epidemiological work, dwelling on both concept and method.[3] In the new introduction to the recent republication of Farr's memorial volume we read that Farr was "a founder, even the founder, of epidemiology in its modern form."[4] The authors of this introduction, Mervyn Susser and Abraham Adelstein, point out that Farr developed tools that have stood the test of time: a standard nosology, standardized death rates, and mathematical models for complex epidemiological phenomena such as the curve of an epidemic or the relationship between population density and mortality.

In explaining Farr's success and influence in epidemiology much importance must be assigned to the favorable circumstances in which he worked. He was the first statistical heir of the newly created system of civil registration. As the chief statistician of England's General Register Office he inherited a wealth of vital data unknown to previous statisticians. Over his forty-year civil service career he commanded the civil registration system and for part of that time the statistical services of the

census as well. Much of his energy went into devising ways to organize and exploit this factual harvest. In this work he had the aid of a staff of trained clerks and eventually of a primitive computer, a model of a Babbage calculator.[5] With this statistical organization behind him Farr was able to bring to the problems he chose unprecedented quantities of statistical information, information collected year after year in a uniform manner; thus in the realm of vital statistics he spoke with unrivaled authority. But as important as this newly available data was and as essential as the devices Farr devised to handle it became, these facts do not in themselves entirely explain his success. Even before civil registration began we find important suggestions and novel departures in the writings of young Farr, then a struggling general practitioner and medical journalist.[6]

The main thesis of this paper can be stated briefly. Farr's basic ideas coalesced in the middle 1830s. By the time he joined the General Register Office full time in 1839 he had formed the conceptual framework around which his later statistical and epidemiological work was fashioned. The key components of Farr's synthesis were: first, a firm commitment to environmental reform in which political and medical ideals reinforced each other; second, a belief that statistics offered the hope of advancing both social progress and medical knowledge; and third, the imaginative use of a fruitful numerical approach Farr discovered in the work of a comparatively unknown British actuary.

Farr was one of many professional-class men who were profoundly affected by the Reform Movement. He was twenty-nine years old and still a student when the Reform Bill became law. As a young general practitioner he watched with much interest the passage of the New Poor Law, the Factory Act, the Municipal Corporations Act, and of course the Registration Act. Behind this political reform and social legislation lay deep concerns about the social order and the stability of established institutions. At the root of this anxiety lay the problem of poverty and the condition of the urban working class.

Recent historical scholarship has shown an ambivalence or tension in the thought of middle class reformers in this decade between on the one hand, a moralistic interpretation of poverty which blamed the poor for their own misery and opposed public intervention on their behalf, and on the other hand, an environmentalist interpretation which explained suffering and moral failure as the products of miserable conditions of life and sought solutions in public action.[7] Farr shared this ambivalence. The editorials for the medical journal he published in

1837, *British Annals of Medicine, Pharmacy, Vital Statistics,* and *General Science,* show no sympathy for "the idle, reckless, vicious . . ." or "the worthless hereditary vagabond."[8] But on the other hand Farr had a genuine sympathy for the worthy poor, an empathy that sprang perhaps from his own humble origins.[9] Relief of poverty and distress was necessary, at least temporarily, to protect innocent life as well as to stabilize the social order. But according to Farr, again in 1837, the punitive welfare scheme masterminded by Edwin Chadwick was an embarrassment to right-thinking men.

> We believe it now to be a prevalent opinion, among the majority of reflecting men, that the grand object of every good government should be to protect the weak from the tyranny or oppression of the more powerful. . . . Even under our reform government, we blush to say that the poor—the weak—who are always least able to defend themselves, have been, in the case of the New Poor-law, very harshily dealth with.[10]

Despite the complexity of Farr's views about the nature and causes of human misery, he generally concluded that public intervention was part of the solution. The state must act. The purpose of its intervention was not paternal care and, consequently, dependency, but it was the provision of the prerequisites for social advancement through the efforts of the poor themselves.[11] Chief among those necessary preconditions was human health.

Current trends in medical thinking about the nature and causes of disease encouraged Farr to equate health and social condition. It was common knowledge that certain epidemic and endemic diseases accompanied human misery. With the decline of the doctrine of contagion during the twenties and thirties in the face of medical experience with typhus, observations on tropical diseases, and the failure of quarantine during the first pandemic of Asiatic cholera, medical men gave renewed attention to conditions which were believed to generate diseases locally. Farr worked out a very sensible compromise on this complex question.[12] In his own disease theory he preserved a small role for contagion and a larger role for specific, disease-causing materials. His major attention was devoted, however, to environmental conditions, particularly poor sanitation and overcrowding, which, he believed, favored both the spread and also the generation of disease.

Farr could reason then on credible evidence that the living conditions of the urban poor were responsible for the notorious insalubrity of large cities. He also adopted the more extreme position of using the

prevalence of preventable disease as a form of social criticism.[13] "For death is the exponent of misery," he explained in 1837.[14] Two years later he referred to diseases as "the iron index of misery."[15] Nearly three decades later we find him claiming: "No variation in the health of the states of Europe is the result of chance; it is the direct result of the physical and political conditions in which nations live."[16] In the 1870s he argued that there were relationships not only between death and health, sickness, mental energy, and "national primacy," but also between the forms of death and "moral excellence or infamy."[17]

It is clear then why Farr's commitment to sanitary reform was intense. It came from both sentiment—from the desire to save innocent lives—and from a conviction that sanitary reform was essential to save Western industrial society from political disaster. It is little wonder then that he regarded the investigation of the causes of disease and premature death and the development of policies of prevention as the most worthy subjects of endeavor. It is also not surprising that he was unable to compromise on final goals or that in describing them he often resorted to intense, emotionally charged rhetoric that his more narrow-minded colleagues in later decades found disquieting.[18]

In the Thirties Farr's reform impulses found more professional focuses as well. He joined a group of extreme advocates of medical reform who constituted the first and short-lived British Medical Association.[19] In a series of editorials and in a reform oration to his colleagues Farr roundly condemned the medical establishment for governing the profession in ways out of harmony with the democratic aspirations of the age and for intellectual incompetence resulting from an ignorance of recent advances in the sciences.[20] Farr believed the reforms he advocated were the counterpart of the political and social reforms underway, and he freely used liberal reform rhetoric in making his case.

Granting then Farr's reformist sympathies, we may still wonder why should he have turned to statistics. Actually, in the early Victorian period the choice was a fairly natural one. Popular interest in statistics in the Thirties was very high.[21] In a flourish of activity statistical societies were founded in London and in several provincial cities. This statistical movement was itself a product of the broader reform movement. The founders of the statistical societies were members of the commercial and professional classes who saw in the use of social facts a valuable weapon for the reform cause. Statistics, these men believed, was a science, but they did not conceive of it as a mathematical science (indeed few of the founding members had mastered more mathematics

than shop arithmetic). They thought of statistics rather as a social science, as the science of social reform.[22] This vision of statistics had great appeal. A new science, so conceived, gave reform sympathies a focus and a program. It promised to defuse party passion and to substitute for rhetoric, certainty based upon the accumulation of irrefutable facts. According to the ideals of that period the science of statistics would discover the principles of legislation and administration. It would make social reform certain or "scientific." What the founders apparently wanted above all was to make reform safe, to find a way of protecting cherished institutions while advocating a limited range of social reforms, mainly educational and sanitary.[23]

Medical men like Farr had a special interest in statistics and in the statistical societies. Sympathies with the reform movement led many doctors to the statistical societies. James Phillips Kay, later Kay-Shuttleworth, is only the best known of many physicians who helped found and direct the early provincial statistical societies.[24] Progressive medical men had special reasons for taking up statistics. Voices in the profession were then proclaiming that statistics, or the Numerical Method, promised to provide the tool to advance medical knowledge. William Guy made this claim in a well-known paper to the Statistical Society of London and so did several other authors who relied on Guy: Doctors Daniel and William Griffin and an anonymous author in the *British and Foreign Medical Review* who discussed Jules Gavarret's work on medical statistics.[25] These men argued that in order to improve itself medicine must emulate the methods of the physical sciences. In particular, physicians must learn to make precise measurements and to use quantitative methods. In an effective section the Griffins compared the "irregularity, uncertainty, and confusion" of medicine whose practitioners relied on memory for facts, used such terms as "generally, not unfrequently, sometimes," and quarreled among themselves on even the fundamentals of their discipline, with the precision, the theoretical harmony, and the success in prediction of the physical sciences.[26] They suggested that if physicians would adopt the use of statistics they would improve both prognostics and therapeutics and also discover the causes of disease.

The idea was extremely attractive and the analogy of the higher sciences probably convincing. But there is one glaring fault with these tracts. Behind the glowing optimism was a nearly complete absence of concrete, practical suggestions. Medicine should employ numbers, but how? The Griffins and the British reviewer of Gavarret's work mention Pierre Louis's studies but criticize them for methodological weaknesses.[27]

Guy pointed to Quetelet's work to establish that complex human events, even those involving the will, when observed in the aggregate, exhibit similar law-abiding tendencies.[28] But there was little specific guidance in these tracts for practitioners. The suggestions of these proponents of the Numerical Method in Britain seem to reduce themselves to little more than this: Collect and arrange all the measurements you can; once you have found your averages, we can tell you how to calculate their limits of error.[29]

Farr was one of few men in early Victorian England to discover fruitful ways of applying numerical analysis to the health problems of interest to the medical reformers. This discovery came early in his career, immediately prior to the publishing of the tracts just mentioned.[30] The origins of the specific quantitative techniques Farr developed can, I believe, be traced to the publications in the early and middle Thirties of the British actuary, Thomas Rowe Edmonds. Edmonds published a work on life tables in 1832 in which he announced an important discovery, that human mortality was geometrically related to human age.[31] More specifically, Edmonds found that the mortality figures for consecutive ages from the best available life tables formed three geometrical series, for the years before, during, and after the period of procreative power. From six weeks of age until six to nine years the mortality dropped 32.4% each year. From then until puberty mortality was at its lowest. During the period of procreative power, mortality increased annually at 2.991%. After the period of procreative power mortality increased much faster, at an annual rate of 7.969%. Edmonds called this discovery the law of mortality. Previous actuaries had used the phrase but not with precisely this meaning. Edmonds believed it was a general law expressing some fundamental feature of human biology. Absolute mortality might differ between two populations and so might the precise limits of the period of procreative power, but the pattern of change of mortality with age was universal.

Edmonds suggested this fact made it possible to compute, by extrapolation, theoretical life tables that would be more uniform and accurate than tables drawn exclusively from experience. In figure 1 we see him comparing mortality rates from three such theoretical tables with rates from commonly used experiential tables. His Village Mortality Table, which had been formed by assuming a mortality of five per thousand at the age of ten and then applying his law, agreed well with Joshua Milne's Carlisle Table. The Mean Mortality Table, which was generated by assuming a mortality of six per thousand at age ten, agreed closely with