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Mervyn Susser, The Last Of The Three American Classical Epidemiology Tenors

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Mervyn Susser passed away on August 14, 2014. Obituaries in the lay press [1] and in epidemiologic literature [2] justly lauded the extraordinary trajectory that took this self-made epidemiologist from South Africa to New York City, in a tale that combined anti-apartheid politics, clinical medicine, sociology, epidemiology, epistemology, and history. Testimonies also unanimously insisted on the key complicity between Mervyn Susser and his lifetime companion Zena Stein, as well as on the epidemiologic triplet formed by Mervyn Susser, Zena Stein, and their son Ezra Susser.

These testimonies are easily available and were written by people who knew Mervyn Susser much better than I did. They can be enriched by Mervyn Susser's autobiographical pieces. [3, 4] Since my commentary is commissioned by the American College of Epidemiology, I will focus on a specific episode of Mervyn Susser's epidemiologic career: his years as Chair of Epidemiology at Columbia University, from 1966 to 1978, because these were crucial years for Mervyn Susser and for the history of our discipline. They began in the aftermath of the 1964 Surgeon General Report [5] and ended about when modern epidemiology opened a new phase of methodologic development.[6] During this transitional period three epidemiologists incarnated a rigorous but still profoundly public-health-based form of epidemiology: Brian MacMahon, chair of epidemiology at Harvard since 1959, Abraham Lilienfeld, chair of epidemiology at Hopkins since 1970 (after having been chair of chronic disease there from 1961 to 1970), and Mervyn Susser.

As mentioned by Mervyn in an interview to *Voices*:

“Important figures for me are Brian MacMahon and Abe Lilienfeld. Their contributions were different, and one is as important as the other. George Comstock and Alex Langmuir stand out as influential and productive

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contemporaries in communicable disease. However, chronic disease was the centerpiece of epidemiology from my perspective.”[7], p. 750)

MacMahon, Lilienfeld, and Susser were born in the early 1920s. MacMahon and Susser lived to be, respectively, 84 and 94, while Lilienfeld prematurely died of a heart attack at the age of 64. Lilienfeld and MacMahon had a master-level degree in epidemiology, while Susser had no formal training. During World War II, Lilienfeld served in the US Army. Susser was voluntary in the South African infantry, later artillery, and finally air force in East Africa, North Africa, Italy. Between 1946 and 1948 MacMahon embarked as ship surgeon in the English Merchant Navy. After the war Susser and MacMahon discovered epidemiology in the UK, in particular in the work of Jerry Morris[8] ([9], p. vii) and of Thomas McKeown,[10] while Lilienfeld became an epidemiologist at Hopkins, in the Department chaired by Kenneth Maxcy, where the legacy of Wade Hampton Frost still held sway.

During the years 1965-1975, Lilienfeld, MacMahon, and Susser became the towering figures of American epidemiology, representing, respectively, Hopkins, Harvard, and Columbia's Departments of Epidemiology. Each of them wrote an influential textbook published in 1960 for MacMahon, 1973 for Susser, and 1976 for Lilienfeld. Their voices were so powerful that it is not exaggerated to call them the three tenors of American epidemiology during the period 1965 to 1975, ten years which had historically distinct traits.

In 1965 the discipline had just emerged from a long battle for the recognition of the health effects of tobacco. But this battle was also a battle for the recognition of epidemiology as a valuable scientific discipline. The first case-control studies [11-15] and cohort studies [16, 17] on tobacco and lung cancer of the 1950's had been received with skepticism and scorn by the greatest statisticians of the time.[18-20] The epidemiologic designs did not conform to the principles enunciated by RA Fisher in the “Design of Experiment.”[21] There was no neat sampling from a target population, no randomization, no univocal analysis and interpretation. Each study had a different design, was based on non-representative samples, did not allow for extensive adjustment for confounding, and case-control studies mixed prevalent and incident cases. It took essentially ten years to polish the design methods, formulate the concepts of bias and confounding, and develop appropriate analytical techniques in milestone publications such as Cornfield et al 1959,[22] Mantel and Haenszel 1959,[23] and MacMahon 1960.[24]

When in 1964 the Surgeon General Committee in the United States [5] and in 1965 Austin Bradford Hill in the United Kingdom [25] summarized the process that had led from the epidemiologic data to the inference of causal carcinogenic effects of tobacco, epidemiology was entering new, exhilarating times. The hope was that the unraveling of the tobacco and health associations was a harbinger of more breakthroughs in other domains of public health. Lilienfeld, MacMahon, and Susser did a lot to consolidate the epidemiologic self-confidence, each on his own way.

According to Susser, “in the United States, Lilienfeld carried that banner [of the epidemiology of chronic diseases], and Brian MacMahon formulated the necessary methodologic structure.”([7], p. 750) Indeed, Lilienfeld had been an important voice

advocating for the validity of chronic disease epidemiology during the 1950s,[26] while MacMahon (with Ipsen and Pugh) imprinted the discipline with their 1960 “Epidemiologic Methods.”[24]

Lilienfeld and MacMahon had similar ideas about the procedure to formulate and evaluate causal hypothesis. They placed the triad Persons, Place, and Time at the center of their causal framework and promoted a two-stage research strategy: generating hypotheses from the analysis of vital statistics, contrasting them on demographic, geographical, or chronologic variables, and testing these hypotheses in analytic studies, most particularly case-control studies.

If Susser agreed with the two-stage strategy, he had a different causal framework in mind that he formulated in a series of lectures given in 1966, when newly invited to take the leadership of epidemiology at Columbia University. The content of the lectures was published in 1973 as a book entitled “Causal Thinking in the Health Sciences.”[27] The book (referred to as “Causal Thinking”) rapidly became a recommended reading in epidemiology programs throughout the United States, and seemingly worldwide, the book having been translated in Chinese, Japanese, and Spanish. When I trained at Hopkins in 1986, it was mentioned as a recommended reading in the syllabus of “Epi 2” as “Casual Thinking ...”.

“Causal Thinking” reflected the sociologic background of Mervyn Susser. The core of the book was not vital statistics, but the architecture of the epidemiologic association, and its related concepts: confounding, mediation, and interaction. Mervyn Susser, disappointed by the lack of causal theory underlying chronic disease epidemiology, proposed an “ecological model” built around the triad Agent, Host and Environment similar to the model previously used in infectious disease epidemiology by Wade Hampton Frost [28] or by John Gordon. [29]

Mervyn Susser conceived the “complex ecological model” in the form of “agent and host engaged in continuing interactions with an enveloping environment.”([27], (p. 30).) The ecological model was too complex to be a direct object of research: “the terms ‘agent,’ ‘host,’ and ‘environment,’ and the associated concepts can be used to describe ecological relationships. They are not precise enough to describe causal relationships (...) When the elements of the three components interact, analysis in terms of cause becomes clumsy.” ([27], p.30) Only models which “simplified the multiple interactions and reciprocities discernible in any ecological model” into a limited number of variables could be evaluated. ([27], p.31)

Mervyn Susser’s attempt to translate the ecological complexity into simple, analytical models led him to formulate an integrated set of methods (cohort, case-control, and cross-sectional designs) and concepts (confounding, interaction, mediation, and causal inference.) to assess the validity of causal hypotheses. “Causal Thinking” was classical in the sense that it dissociated the causal framework from its exploration using analytic designs, but it also anticipated the structure of the first modern epidemiologic texts published almost 10 years later. [30, 31] The exception was the concept of bias, not discussed in “Causal Thinking.”

In “Causal Thinking” the use of arrow graphs to depict relationship between multiple variables, causal pathways, and the potential effects of confounding, distorter, suppressor, explanatory, intervening (mediation), moderator or component variables proved extraordinary premonitory too. Susser imported the graphs from sociology, and in particular from the work of Blalock, and used them in a way analogous to the way DAGs are used to explore the causal structure of causal models in the context of the potential outcome framework. Clearly, Susser ventured alone in the late 1960s in a path that became much traveled by epidemiologists 30 years later. Indeed, after having been eclipsed for some times by the methodologic tsunami of modern epidemiology, initiated at Harvard in the 1970s, “Causal Thinking” has recently regained some attraction for modern researchers.[32]

If Susser, building on Lilienfeld and MacMahon, contributed to the transition to modern epidemiology, he always remained critical about an excessive emphasis on the role of methods in epidemiologic research. The health of the public came first. With hindsight, the diffidence of Lilienfeld, MacMahon, and Susser towards the new, mathematical theory was unwarranted. Their fear to see epidemiology depart from public health and become a theoretical discipline did not materialize. The new methods strengthened rather than weakened the place of epidemiology in society and academia.

A complete picture of epidemiology during the years 1965 to 1975 should include the contributions of Austin Bradford Hill, Jeremy Morris and Richard Doll in the UK. However, Lilienfeld, MacMahon, and Susser occupy as a triplet, a specific place in the epidemiologic firmament for having symbolized a successful and self-confident version of American epidemiology. Susser was the last survivor of these three epidemiologic tenors.

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Figure.
Zena Stein and Mervyn Susser, in 2001 at a Symposium entitled “Turning the World Around,” held in honour of Mervyn Susser and Zena Stein at the Mailman School of Public Health, Columbia University, 2001 (Source: Zena Stein and Mervyn Susser).