



From the American College of Epidemiology

## Epidemiology as a liberal art: from graduate school to middle school, an unfulfilled agenda

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### ABSTRACT

Calls by Lilienfeld, Fraser, and others some three decades ago to introduce epidemiology into undergraduate college education remain largely unfulfilled. Consideration of epidemiology as a “liberal art” has also led to exploring possibilities for introducing epidemiology into early education: to high and even middle schools. Adding epidemiology to school curricula should help educate the public to understand science-based evidence concerning the causes and treatments of disease, help inoculate them against a tsunami of biased and fraudulent media messaging, and permit advancing postgraduate education in epidemiology to even higher levels of scholarship.

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There are two forces on a collision course in our present society and epidemiology is involved in both of them. First is the absolute tsunami of health information that crashes on the public every day. The second is a public that is increasingly ill prepared to distinguish the silly from the sensible, the hype from the hypothesis.

You all know about the tsunami. I teach my Evidence-based Medicine course on a Tuesday and I can walk into every class with that day’s New York Times under my arm and find examples relevant to the day’s topic. These are not just in the Tuesday Science section but often on the front page (sometimes above the fold). They are also increasingly from the Business section. Much has been written about the uncertain information too often generated by epidemiologists. Indeed, Ioannidis [1,2] has suggested that most research findings are inflated or false. To be sure, many published results must be wrong because they directly conflict with so much other published epidemiologic research going in the other direction. But this is not my point for today. Science will always produce

false leads but science is also self-correcting—we just need to be more efficient at reducing error—and a lot of work is going into making it so [3].

My topic focuses on the other colliding force—the unpreparedness of the public to assimilate and put into perspective the research generated by us. One point of interaction, previously addressed by the College, has been to think about training Journalists to better understand our scientific articles so that they can be more accurately reported to the public. This is important and more needs to be done but this also is not my issue today.

My story begins in 1978 when Lilienfeld et al. [4,5], writing in the *International Journal of Epidemiology*, described Epidemiology 101, a course for undergraduates at Hopkins and suggesting the establishment of Departments of Epidemiology in Universities, similar to “those in such fields as statistics and biology”. In 1987, Fraser [6], an epidemiologist and President of Swarthmore College, published a fascinating article in the *New England Journal of Medicine* entitled “Epidemiology as a Liberal Art.” His thesis was “Epidemiology has features that resemble those of traditional liberal arts, this makes it fit for inclusion in an undergraduate curriculum ... As a low technology science, epidemiology is readily accessible to nonspecialists. Because it is useful for taking a first look at a new problem, it is applicable to a broad range of interesting phenomena. Furthermore, it emphasizes method rather than arcane knowledge and illustrates the approaches to problems and the kinds of thinking that a liberal education should cultivate: the scientific method, analogic

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thinking, deductive reasoning, problem solving within constraints, and concern for aesthetic values". By "aesthetic values," Fraser was referring to the elegance and simplicity that represents the best epidemiologic studies.

Fraser's mission was taken up by the Institute of Medicine in 2003, which recommended teaching epidemiology and public health at the undergraduate level [7] and in 2008, the Association of American Colleges and Universities made recommendations for undergraduate public health education including epidemiology [8]. But a quarter of a century after Fraser, it was estimated in 2007 that there were only about 100 colleges teaching epidemiology among all undergraduate degree programs [9], a tiny fraction of the 2400 four-year undergraduate programs, and a major in epidemiology is very rare. Epidemiology is typically taught either as a single course or as part of joint BA/MPH programs. At Yale, the School of Public Health started a 5-year joint BA/MPH degree program several years back and now some of our most selective MPH students come from Yale College. Clearly, there are opportunities for bringing epidemiology to many more undergraduates. But even if epidemiology became a staple of all liberal arts degrees, this would only help the 40% of the United States population who attend the college.

Any reason, therefore, not to teach epidemiology in high school or even middle school? This would provide opportunities benefiting the entire population. We are quite used to having biology, physics, and calculus taught in high school. Why not epidemiology? It is a national disgrace how badly too many of our high school students are taught mathematics and science (according to the Organization for Economic Cooperation and Development, in 2012, the United States ranked internationally 23rd in science and 31st in math [10]). Others have written specifically about the role of epidemiology and public health as a vehicle for teaching mathematics and science in high schools [11].

Epidemiology in schools: can you imagine anything more exciting than teaching bright high school students: John Snow, the 1793 yellow fever epidemic; James Lind, the Woburn leukemia cluster, a global influenza pandemic (they could all watch the film *Contagion*)? Well, yes. How about teaching epidemiology to students from tough schools, who do not want to be in school? Surely they could be engaged in studying bioterrorism and the anthrax attacks, the elaboration of the AIDS epidemic, how one would study the long-term effects of marijuana and alcohol use, whether 32 oz cans of caffeinated beverage are harmful or the long-term consequences of head injuries after playing football?

There have been some notable attempts at bringing epidemiology into high schools and even into middle schools. In 2009, McClamroch and Montgomery [12] described a successful program to teach 16 sophomore high school students infectious disease epidemiology. There is the Epidemiology Education Movement supported by the National Center for Research Resources of the National Institutes of Health, which is developing materials for middle and high school students [13]. Kaelin [14] of Montclair State University has developed a "Detectives in the Classroom" curriculum for middle and high school epidemiology based on five essential questions, the first being the fundamental one: "Why do some people get sick, while others remain healthy?". Another innovation is CDC's EXCITE program: "Excellence in Curriculum Innovation through Teaching Epidemiology and the Science of Public Health," which is a developing epidemiology teaching curriculum from kindergarten through 12th grade [15].

All these programs are well aware of the need to prepare teachers (at schools and colleges) who will be capable of teaching at these levels; almost certainly, a different set of skills than teaching in graduate school. They suggest summer internships and workshops for epidemiologists to build the cadre of teachers who can

carry on this work. The Robert Wood Johnson Foundation has had a Young Epidemiology Scholars program for high school students, a national scholarship program administered by the College Board [16] but sadly this has been discontinued. The RWJ Foundation also has professional development workshops for high school teachers (called Teach Epidemiology [17]) who teach science, mathematics, health, social studies, and related disciplines.

So, there are quite a few green shoots and I wonder about a possible role here for the College to further enhance this process, perhaps by offering its own teaching workshops, collating all the available and appropriate resources, or creating new documents for teachers and schools. Perhaps the College has a role to play in working with groups that have already shown an interest in developing undergraduate and school epidemiology programs?

Some of the impulse to broaden the teaching of epidemiology comes from estimates that the future public health workforce will be substantially undersupplied [7]. But even more important, in my view, bringing epidemiology to a much wider audience, indeed to the entire school population, could have a substantial beneficial impact in preparing the public to disentangle those important and validated health messages that they should pay attention to from the tsunami of misinformation and provisional results that need replication and, of course, all the quackery to which the public is subjected.

But also consider this. How much would our discipline benefit if, just like biology or physics, we could teach college level epidemiology to students who had already been introduced to the discipline in middle or high school; how much we could advance our graduate teaching if students came to it already prepared from exposure to epidemiology at school and at college; and how so many more of the nation's brightest students might be attracted to join our discipline after being exposed to exciting but rigorous epidemiology courses early on in their academic life? Surely, this is an agenda worth fulfilling?

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