A Consequential Future for Epidemiology

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Epidemiology has always been consequential. Although we may not often think about it, many of us are alive today thanks to epidemiology. In 1900 – a few years earlier than my grandparents immigrated to this country – life expectancy in the U.S. was 47.3 years. By the end of the century it was 76.8 yearshttp://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5.htm, with death rates declining a further 16% by 2010 (1<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5.htm>).

The great public health achievements responsible for these improvements included prevention and control of virulent childhood infectious diseases, cardiovascular diseases, cancer, motor vehicle injury, occupational injury; dramatic advances in maternal and infant health; and after mid-century, tobacco control. For each of these problems, epidemiology was used to identify and quantify the magnitude, to identify and demonstrate etiology and preventive opportunities, and to establish the effectiveness of interventions. So there is no question that epidemiology has been consequential.

It is also becoming more powerful. Although many fundamental epidemiologic concepts presented in classic textbooks from 50 years ago remain useful and valid today, our understanding of these concepts has become more sophisticated, many refinements have been made, and many new methods have been developed to collect and analyze data. Epidemiology is being used in a whole host of new areas, such as pharmacoepidemiology, and epidemiologists regularly collaborate with scientists of all kinds.

This record of achievement gives us confidence and optimism as we look toward the future of our discipline. We will need that confidence and optimism as we continue to develop our understanding and methodology to meet the public health challenges of the future.

New infectious diseases will emerge, as did HIV and SARS, and familiar ones such as Ebola virus, Dengue fever, and malaria will enter new populations, aided by urbanization, globalization, and climate change. In addition, many of our great public health achievements, such as control of tobacco – responsible for 18% of US deaths in 2000 (2) – remain to be completed.

Furthermore, the obesity epidemic and the aging of the world’s population – the fruit of past public health achievements – are increasing the prevalence of arthritis, dementia, diabetes, and other chronic conditions associated with the cumulative impact of deleterious exposures and lifestyles. Even if we continue to enjoy increasing life expectancy, the burdens that these conditions will place on quality of life, health care services, and the economy give cause for alarm.

In addition, there are a number of public health problems where epidemiology has yet to make substantial progress. For example, our country continues to lead the industrialized world in firearm injuries and sexually transmitted infections.

Health disparities continue to fester. Notwithstanding nearly three decades of reports, goals and objectives, agenda-setting, targeted research, and other initiatives, health disparities remain prominent in many areas. Indeed, a recent review found no net improvement.(3) Similarly, despite various pronouncements and programs, the extent of racial/ethnic diversity in epidemiology and other public health research fields remains very limited, glaringly so in regard to advisory panels, editorial boards, study sections, and other influential bodies.

Social determinants of health are fundamental factors underlying health disparities, both domestic and global, as well as problems such as violence, human trafficking, civil disorder, and military conflict. Social determinants also affect the extent to which humans are hazardous to the health of the environment, polluting and depleting resources such as drinking water and fisheries, intensifying climate change and acidification of the oceans, and weakening the life-support system upon which we all depend (4).

Can the epidemiology of the 21st century succeed against this diverse array of threats to public health? Since social determinants are commonly defined as “the conditions in which people are born, grow, live, work and age”(5), are epidemiologists called upon to transform the conditions of human existence? Is that asking a little much from a relatively small and under-resourced profession?

Yes, that is a little too much to ask of epidemiology. Other professions must play key roles, and it is reasonable for us to defer to them. But regardless they will need to use the concepts and methods of epidemiology to succeed. Who are better equipped to apply those concepts and methods than epidemiologists? When he accepted the College’s Abraham Lilienfeld Award in 1997, John Last declared, “We need innovative, transdisciplinary approaches. A strength of epidemiology is that it is transdisciplinary already, sometimes anyway; so we are quite well placed to lead a paradigm shift in scientific thinking. We would be better able to lead the way if we were more open to ideas from well outside our usual working territory, if we were even more transdisciplinary ...” But can epidemiology do that?

Although much of epidemiologic research concerns specific disease entities and examines risk factor-disease associations, epidemiologists also survey the entire public health landscape, paying attention to the broad range of health conditions and determinants as well as to their interrelationships. Epidemiologic thinking embodies a systems analysis approach to public health, taking into account interdependencies and feedbacks, and identifying critical pathways and strategic locations where causal processes can be blocked.

In a recent special issue of *Public Health Reports* on Applying Social Determinants of Health to Public Health Practice (6), Dean, Williams, and Fenton encouraged consideration of the broader determinants of health “as part of a more comprehensive approach to improving health, addressing health inequalities, and accelerating health impact. Implementing action on social determinants involves understanding the dynamic interaction among the behavioral, clinical, policy, systems, occupational, and environmental determinants of health; identifying synergisms and antagonisms; and employing cost-effective strategies to achieve sufficient and sustainable population coverage and scale.” (7)

At the same time, from an even broader perspective, these systems and institutions themselves arise as emergent phenomena from the decisions and actions of innumerable individual agents – specifically, humans. Each of these systems and institutions has a history of how it came into existence through the actions of individuals, and how its operations reflect their activities.

Direct health impacts of individual behavior are obvious when, for example, a pedestrian is injured after being struck by a drunk driver or a water source is contaminated by an executive’s decision to discharge hazardous waste into a river. But we also recognize that many small actions by a large number of individuals can have major impacts. For example, investment and consumption behavior influence business practices that affect farmers, workers, consumers and the environment. The movements for socially responsible investment and purchasing behavior to support fair trade, fair labor practices, and corporate responsibility are predicated on these influences.

But these movements are currently dwarfed in scale by the amount of the public health burden that has resulted from corporate promotion of overconsumption of products harmful to personal health or the environment (e.g., tobacco, alcohol, unhealthful foods, sedentary entertainment, automotive transportation, firearms, lead-based paint, leaded gasoline). In fact, major portions of our economy – in manufacturing, services, employment, and investment – involve economic activities that harm public health. The corporations that carry out these activities are owned by wealthy individuals but also by university endowments, pension funds, and mutual funds in which many of us, our families, and our associates invest our 403b’s and 401k’s.

During the 1990s, former APHA President Eugene Feingold and former Surgeon General C. Everett Koop repeatedly put forward proposals calling for TIAA-CREF to begin an orderly divestment of its more than one billion dollars of tobacco stock holdings.(8) The proposals were opposed by the CREF trustees and garnered support from less than a quarter of proxy votes cast. Since it was known by then that the tobacco industry’s profitability depended upon initiation of smoking by adolescents, the CREF trustees were essentially arguing that addicting teenagers to tobacco was important for university retirees’ financial wellbeing.

Probably the CREF trustees did not conceptualize their recommendation in those terms, relying instead on their fiduciary responsibility to obtain the best investment return for CREF members. But is it possible, then, that behaviors that lead to and aggravate public health problems proceed from a reluctance or failure to recognize the indirect consequences of actions? Do harmful institutional behaviors reflect action in the context of narrow awareness – from overemphasis on familiar, readily observable, geographically proximate, short-term consequences of behavior to the neglect of less familiar, more subtle, more distant, and long-term consequences?

In some interpretations, the CREF tobacco divestment issue illustrates a fundamental conflict between capitalism and public health. However, similar conflicts arise for any system of economic organization. Most actions have a multiplicity of effects, direct and indirect, short-term and longer term, geographically local and more distant. These effects may be experienced by different people, and any given effect may be beneficial to some but harmful to others.

This complexity, as well as the probabilistic nature of many of the connections, suggests that it may not be practical to demonstrate an optimal course of action in many situations. Furthermore, the people who make the decisions will typically not have complete information nor have adequate time and resources to investigate the questions in depth, and their decisions will often be influenced by other considerations. Even decisions with enormous consequences, such as the decision to invade Iraq in 2002, come about by the complex interaction of many influences, of which factual and scientific reasoning form only a subset.

Although this realization may appear pessimistic, it is reasonable to suppose that people who see more clearly will generally arrive at better decisions and act more effectively than people who see less clearly. Similarly it is likely that people who are more intelligent will generally arrive at better decisions and act more effectively than people who are less intelligent. In the same vein, people who have broader awareness will generally make better decisions and act more effectively than people whose awareness is narrower. If we accept this proposition, then a strategic role for epidemiology is to identify factors – developmental, microbiologic, nutritional, educational, social, environmental, etc. – that influence intelligence and awareness.

A familiar example of such factors is iodine deficiency, the leading cause of preventable mental retardation (9) that has also been linked to lower academic achievement in school children (10). Another example is childhood lead exposure(11). As noted in a CDC fact sheet, “Even low levels of lead in blood have been shown to affect IQ, ability to pay attention, and academic achievement.” (12)

Extensive research has demonstrated numerous deleterious effects of stressful environments during early life and also numerous beneficial effects of nurturing and intellectually stimulating environments. So there are available interventions to improve intelligence and executive function, particularly for the approximately one-third of children who grow up in poverty.

During the past two decades there has been enormous progress in scientific understanding of psychological, social, and biological influences on thinking and decisionmaking. Some of this knowledge is regularly applied by corporations to influence purchasing behavior, by fundraisers to attract donations, and by political organizations to influence voting behavior.

By collaborating with psychologists, neuroscientists, economists, and others, epidemiology can help to extend the knowledge and measurement technologies to increase understanding of the determinants of awareness and behaviors that affect public health. For example, might particular corporate stock incentive arrangements narrow the awareness of corporate directors and executives?

In his book *Planetary Overload* and elsewhere, leading epidemiologist Anthony McMichael has eloquently described how contemporary human collective behavior is degrading the support systems on which human life depends. Can epidemiology help us to understand the determinants of individual thinking and action that contribute to human collective misbehavior and identify ways to counter them?

This year, at about a dozen schools in disadvantaged communities, thousands of students sat with their eyes closed for 15 minutes at the beginning and at the end of each school day, as they participated in the Quiet Time program, a project of the David Lynch Foundation, which funds similar programs in countries all over the world.(13) The experience in these schools is that there is less student conflict, better attendance, fewer suspensions, an improved classroom climate, greater academic achievement, and reduced teacher burnout.

Four San Francisco schools participate in Quiet Time, and 15 Bay-area schools are on a waiting list. The David Lynch Foundation also sponsors Operation Warrior Wellness, which disseminates Transcendental Meditation to veterans suffering from PTSD, as well as programs for prisoners, residents of homeless shelters, and victims of sexual violence.

Although there have been many studies of the effects of Transcendental Meditation, as an epidemiologist I am particularly intrigued by the Quiet Time program because it is a community intervention that changes collective behavior. The educational outcomes that have been studied should be associated with improvements in public health indicators. Moreover, the scale of the Quiet Time program in San Francisco may have created the opportunity to measure impacts on public health indicators such as arrests, pregnancies, and sexually transmitted infections.

Epidemiology that increases our understanding of determinants of collective behavior and demonstrates effectiveness of interventions to improve collective behavior certainly qualifies as consequential.

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