Epidemiology in the Experience of the United States Centers for Disease Control—A Personal View

Disease Control in the United States—An Historical Perspective

This century has been marked by unbelievable progress against infectious diseases everywhere. In 1900, the leading causes of death in the United States were heavily influenced by infectious diseases. Indeed, when the question is raised in terms of years of life lost rather than absolute numbers of deaths, infectious diseases were four of the five leading causes. One by one, these ancient scourges have yielded to medical knowledge and public health practice, resulting in dramatic reductions in, among other diseases, tetanus, diphtheria, poliomyelitis, and typhoid fever. The change has been so astonishing, that diphtheria, the third leading cause of years of life lost in 1900, accounted for only three cases of disease in children under the age of 15 in the entire United States in 1982 (provisional data). The cumulative effect of each of these victories has been an increase of over 25 years in life expectancy at birth for United States citizens in the 20th century.

What is remarkable about this increase in life expectancy is the relatively small part played by miracle drugs, highly technical surgical advances, and a $200 billion a year health care industry. By and large, the improvements can be credited to very simple, yet often poorly organized, activities including improved housing, safe water supplies, waste disposal, food safety regulations, environmental improvement, and immunization programs. The primary effect of these programs has been the reduction of infant and childhood mortality. Indeed, it has been said that if all hospital beds were to disappear overnight, it would have less of an effect on health than would losing one of these simple preventive measures. Epidemiology and epidemiologists have been critically important in developing and implementing these preventive measures.

The Current Situation

A current look at mortality shows a picture unimaginined at the beginning of this century. Only one infectious disease (pneumonia and influenza) is still found among the 10 leading causes of death. Not a single infectious disease ranks among the five leading causes of years lost (accidents and adverse effects, malignant neoplasms, diseases of the heart, suicides and homicides, and cerebrovascular diseases). Nevertheless, it is striking how many of these causes of years of life lost are potentially preventable. Violence still eludes the best control efforts. Accidents are largely preventable. Diseases of the cardiovascular system have shown significant declines in the last decade and
are highly vulnerable to prevention procedures. While it is true that overall cancer rates have been increasing in this country, the fact is that noncigarette-induced cancers are declining, and a major impact on total cancer mortality in the United States could be made simply by eliminating cigarette smoking.

In light of the fact that some 1,000 persons (40 per hour) die each day from cigarette smoking, the apparent preoccupation in the United States with nitrates, saccharin, and other food additives will baffle historians 100 years from now. Cigarette smoking claims more lives in three years than all United States wars combined. If the same number of persons died from anthrax or smallpox, society would protest and demand immediate, effective action. Yet the toll exacted by the cigarette-smoking epidemic is concealed behind death certificates which read: heart attack, stroke, cancer. Cigarette-smoking is the smallpox of the 1980s in the developed world, and society will be judged quite harshly in the future for not having dealt with this fact in a straightforward manner.

The epidemiological analysis of these statistics leads to a sobering conclusion: while life expectancy at birth in the United States has increased by over 25 years since 1900, most of this is due to a decrease in infant and childhood mortality. Viewing life expectancy from the standpoint of middle age, 20th-century medicine, science, and technology have actually enabled modern man to outlive his grandparents by only six years.

On the other hand, there is evidence that some very important actions such as not smoking, drinking in moderation, exercise, and proper diet can make a difference of a decade in the life expectancy of a middle-aged person. In essence, what individuals do for and to themselves can be twice as powerful as all the benefits of modern medicine. If this is true, then the major thrust of public health in the 1980s should be to exploit as a priority the life-giving powers of the individual.

The advances of preventive medicine in the past decades have largely been elitist in the sense that small groups have decided, for example, to chlorinate water supplies, drain swamps, and regulate food preparation. These decisions have been carried out through social and environmental manipulation. The advances of the future will still involve some social and environmental manipulation—such as attempts to reduce tar and nicotine levels in cigarettes and to prevent the introduction of chemicals to water supplies—but the major disease prevention accomplishments in the United States will be seen in billions of decisions and actions taken by millions of individuals on a day-to-day basis. Taking and acting on those decisions will require education—promoting the development of good life habits and equipping individuals to make informed decisions—the type of education that has not been a traditional characteristic of the health care industry. Historically, society has looked to families, churches, and education systems to instill such values and skills.

The Developing World Today

What is the contemporary scene in the developing world, meanwhile? The developing world is also marked by a health revolution as it travels through a public health/epidemiological transition, similar in many ways to what happened in the United States. Everywhere, infant mortality is decreasing, life expectancy is increasing, and birth rates are falling.

Life expectancy in the developing world is now at the level found in industrialized countries in the 1920s and the 1930s and it could reach an average of 65 to 70 years by the year 2000. But the developing world has a double problem for the coming decades. It will continue to live with the historical problems of infectious diseases, malnutrition, and population pressures; at the same time, it will increasingly be victimized by some of the negative health consequences of development. Already surfacing are problems of occupational hazards and exposures, environmental issues of chemical waste and toxin exposure, and health difficulties related to affluence. In all likelihood, by the year 2000 the major health problem in the third world will be the effects of cigarette smoking.

Development of sound epidemiological baselines for tomorrow will depend upon actions taken today. Data are needed on the occurrence of disease, populations at risk, points of effective intervention, and population density, movement, and disease patterns.

Disease surveillance is the foundation on which future health programs must be built. Quantification of disease problems and the identification of populations at risk must be completed before decisions are made regarding large-scale health programs and the necessary investment of personnel and other resources. In most developing countries, it will be necessary to train health workers to recognize, collect, and analyze such data, especially in predominantly rural populations.

Actions for the Future

If teams of health workers can be taught aggressive surveillance techniques and other epidemiological practices, they will be able to identify with accuracy
the disease problems that demand attention and priority. In turn, they will have the knowledge and authority to teach leaders of their countries to deal effectively with these problems. An analysis of current operational programs indicates that the key deficiency in delivering vaccine to those who need it is managerial, not technical. Developed countries can help by assisting developing ones to train their health workers in planning, implementing, and evaluating their own primary health care programs. However, the situation can improve only if the people of each country, as well as health care personnel, are involved in prevention and primary health care. Community involvement in these processes is key to any major improvement in health in developing countries.

There is growing recognition of the need for epidemiological support for all aspects of disease control and prevention programs in countries throughout the world. The manifold use of epidemiological services is of increasing interest to public health practitioners, including administrators and planners at all levels of management—national, state, and local. It is evident that development of comprehensive epidemiological services and appropriately trained epidemiological specialists is critical to the successful implementation of a country’s health policy.

Training Programs

In 1951, the U. S. Centers for Disease Control (CDC) recognized that existing academic-oriented epidemiological training programs were not adequately producing the type of field epidemiologists required to effectively deal with the diseases that caused most of the morbidity and mortality in the United States. To address this need, CDC initiated a preceptorship type of training program in epidemiology called the Epidemiologic Intelligence Service (EIS). The program focused on closely supervising trainees as they worked on real problems in the community and resembled in concept the clinical training programs common to all medical specialties. Credit was given for the experience obtained in the program so that graduates could take the specialty board examination in public health and preventive medicine. During the ensuing 32 years, more than 1,200 trainees, primarily physicians, have participated in the program and have been assigned to training positions at either the country or state level where they have provided useful services while being trained simultaneously. They have worked on a variety of infectious and noninfectious, acute and chronic disease problems; these efforts represent some of the best epidemiological work performed in the United States. EIS officers have become the critical cadre in the country’s disease surveillance and investigative network. They analyze and report data, investigate outbreaks of disease, develop methodology for disease control and prevention programs, and utilize these data for planning, managing, and evaluating health services and programs.

Collaborative Efforts

The success of this CDC program and its potential value to health programs in the developing world has been recognized by WHO. In 1980, the WHO Regional Office for South-East Asia (SEARO) in New Delhi, India and CDC initiated the Global EIS and supported Thailand in developing the first such program. CDC contributed an experienced medical epidemiologist from its staff through WHO to serve as a full-time resident consultant to the program. Some additional support funds were provided by SEARO. Yearly classes have consisted of four to five trainees, and their assignments have covered some of the major public health problems in the country. The Ministry of Health has recently given the program permanent status in its organization. There have been nine graduates of the program, all of whom have accepted epidemiological positions in the Ministry of Health. Another program was initiated in Indonesia in October 1982 with CDC and SEARO support, and one CDC medical epidemiologist was again assigned through SEARO to serve as a training consultant.

An epidemiology training program for a specific country must take into account the health problems and available resources of that country. Critical to the program is the concept of a two-year, supervised, field training program where the trainees are exposed to the techniques of applied epidemiology through preceptors training. The trainees provide service to the central and participating state governments while being trained.

CDC will, if possible, support such programs by assigning an experienced staff epidemiologist to work with a counterpart epidemiologist in supervising the trainees. This support would be provided for approximately five years, at which time full supervisory responsibility for training should be assumed by the host country, potentially utilizing graduates of its own program.

This program can provide epidemiological services to the country while trainees are being exposed to epidemiology and its role in disease control and preven-
tion. The trainees materially help the Ministry of Health attain the goal of health for all by the year 2000. The graduates provide a steady increase in the number of trained field epidemiologists available to take on positions of responsibility in preventive medicine in the country. As the graduates assume these positions, they can provide day-to-day supervision of new trainees and make it possible to gradually increase the number of trainees accepted into the program each year.

Conclusion

Any discussion of the role of epidemiology in public health and the prevention of disease is, in truth, a discussion of the measurement of national and international civilization. The practice of public health at CDC, or any other place, is the practice of social justice. It is the effort to make health a matter of choice for all—not chance for some.

It has been said: ‘‘We cannot remain consistent with the world save by growing inconsistent with our own past selves.’’ There are many things to learn from one another. In the last decades of the 20th century, the measurement of national stature will be the way countries treat their own people and one another. Epidemiology, its practice and persuasion, is a key to universal social justice.

The International Clinical Epidemiology Network

Background

Achievements in biomedical and behavioral research have raised society’s expectations, yet many segments of society risk being disenfranchised from access to the fruits of those successes. A disproportionate amount of the world’s health resources is spent on treating diseases of the urban affluent, while masses of periurban and rural poor suffer and die from common preventable or treatable maladies. This imbalance raises fundamental questions regarding resource allocation, efficacy of interventions, and community priorities—questions which impinge upon the quality and quantity of care for individuals and the health status of populations.

These problems cannot be addressed by basic biomedical research. Nor can investigations conducted on small samples of hospitalized patients alone provide sound bases for either clinical or policy decisions. Indeed, the hospital perspective tends to distort the physician’s impression of the real burden of illness in terms of numbers, distribution, and extent of physical impairment. In all countries, uncontrollable health care costs, to say nothing of inequities in “north-south” and “urban-rural” distribution of services, reinforce the need for more rational approaches to difficult choices.

An adequate picture of the distribution of diseases over time and place requires that data on hospitalized patients be linked to the population from which they come. Further requirements include identification of high-risk groups and critical evaluation of the diagnostic, therapeutic, and preventive interventions (drugs, vaccines, surgery) that will have the greatest effect on the priority health problems of the entire population.

All this is the province of epidemiology, and involves the application of scientific methods and statistical reasoning to the problems of disease and health care in populations as small as the communities served by a health center, hospital, or medical school, or as large as the global community. The use of epidemiological concepts and methods is essential for estimating the burden of illness experienced in a community; for identifying environmental, behavioral, and occupational health hazards; for establishing the efficacy of preventive, diagnostic, and therapeutic measures; and for assessing the relative impact and cost-effectiveness of different combinations of resources and services used to improve the health status of populations.

Epidemiology as a discipline was originally conceived by clinicians, but in the past 60 years it has developed outside the mainstream of clinical medicine, largely within schools of public health. Over time, clinicians became increasingly involved in laboratory research and drew further away from their colleagues...