

Health in the Decades Ahead

by DAVID HAMBURG, M.D.,
and SARAH SPAGHT BROWN

We must develop a broader science base and a more compassionate society, not only to cope with disease and disability but to improve the quality of life—and perhaps even to survive as a species

This is a perplexing time in which to consider health care. The current health sector is in great ferment and, consequently, glimpses into the future are particularly clouded. It is a time of satisfactions and concerns, of progress and poverty, of hope and apprehension. From this ferment, important changes in the health care system will probably occur in the next decade, though the outlines of these changes are still somewhat unfocused. As a consequence, a look toward the health care system in 80 years is especially difficult; we don't really know what even the next 10 years will bring, let alone 80. But some general observations can be made nonetheless.

Before elaborating on the future, it might be helpful to review very briefly certain aspects of the health sector in both the present and in the past. Certainly there are many sources of satisfactions from such a survey. The public health progress made in this country and other industrialized countries in the 19th and 20th centuries has had an enormous impact on health. Progress in sanitation and the hygiene sciences—particularly in the handling of excreta and in the recognition of the need for uncontaminated water—has improved the human condition immensely. Research in recent decades has also aided in bringing many of the most destructive infectious diseases under control—some by the immunization process, others by the use of antibiotics.

Similarly, progress in agricultural production has led to an unprecedented adequacy and dependability of nutrition in the Western world. This strengthened food supply and dissemination has done much to limit infectious diseases. Resistance to an even wider range of diseases beyond the infectious ones has also been encouraged by these agricultural developments. There have also been changes in reproductive practices, which hold out at last the twin possibilities of a better balance between population and resources, and of adequate care for every child.

In addition to these broad movements in agriculture, sanitation, and population, there have also been truly extraordinary advances in the life sciences, many of which have occurred only within the past quarter century. The revolution in modern biology—or, more accurately, the revolutions in modern biology—have been described at length by others. Our understanding of basic life processes at both the cellular and sub-cellular level has expanded enormously in recent years; often, though not always, this increased understanding has been translated into new diagnostic, therapeutic, and preventive interventions in the health care sector. For example, the health care system is now able to offer the detection of genetic defects in a human fetus through prenatal diagnosis.

These many advances in the biomedical sciences

This article is adapted from Dr. Hamburg's speech at The Next Eighty Years conference, held at Caltech in April 1977.

have also been joined by recent strides in the behavioral and social sciences. Individually and in concert with the biomedical sciences, these disciplines are demonstrating their great potential for the protection and improvement of human health, as is suggested, for example, by studies on the relationship of stress to disease. The long-standing sciences of epidemiology and biostatistics—the core disciplines of public health—have proven continuously in recent years their relevance to health, as have the newer sciences of nutrition, and environmental and occupational health.

So, altogether, the health sciences are stronger today than ever, with the major strides in health being in the areas of infectious diseases, and the development of immunizations and antibiotics. Of course, new developments growing out of our sizable investment in health sciences research continue to appear on the horizon. For example, comprehensive treatment for both hypertension and schizophrenia are almost within our grasp.

Beyond these scientific and technical achievements, recent decades have seen great changes as well in the structures and processes through which health and medical care are provided. Though some view these system changes as a net loss—such as those who mourn the apparent passing of the family physician—surely there have been extraordinary gains. In 1974, roughly 88 percent of the population of the United States was covered by at least some form of health insurance, either privately purchased, or through the massive Medicare and Medicaid programs. The availability of physician care to individuals has increased, as has hospital-based care and that provided by various long-term-care facilities. Life expectancy in the United States is at an all-time high—68 for men and 76 for women. In 1900 the comparable figures were 46 and 48.

This same glance at the past and present, and the changes between, also reveals deficiencies in the health sector. For example, there is still reason for concern that some population groups—particularly the poor and socially deprived—do not benefit adequately from the medical advances and health care improvements alluded to earlier. It is also clear that certain age groups, such as the elderly and adolescents, do not receive adequate health supervision, irrespective of income or social status. This younger group in particular is almost invisible in terms of special health care services, research, or education focused on the prevention of disease. And yet it is during this key transitional

period that so many habits—both health-enhancing and health-compromising—are developed and carried into adulthood. These behaviors hold significant consequences for health and well-being in both the short and long term.

Another deficit of great concern is that the health sciences research effort has not been in reasonable relation to burden-of-illness indices, either in this country or in the world at large. Even though specific disease categories rank differently depending on the measure used, it is clear that the funding of research does not relate in a rational way to the illness burdens of the nation. The mental illnesses, for example, are a great burden in terms of hospitalized individuals and economic costs, and yet the funds expended on mental health research in this country are limited. This lack of “fit” is also true in professional education. The education and specialty training of physicians and other health professionals has not been structured to take account of the burden of illness. These discrepancies are currently generating growing interest in medical and scientific communities.

Another lack that is apparent in surveying the current health scene is the insufficient emphasis placed on research that assesses both the risks and benefits of diagnostic and treatment interventions—particularly before such interventions come into widespread use. Most of what is actually done in medical care has not previously been evaluated in the most thoroughgoing scientific way. It is necessary to determine more than has been done in the past about the efficacy of diagnostic, treatment, and preventive interventions. The cost and ethical implications of not conducting such research are most serious, though there are hopeful signs that this assessment issue is being widely discussed in both the public and private sectors and that corrective actions are being considered. If research is envisioned as a series of related disciplines that are linked to each other along a continuum and contribute to each other, it becomes clear that these links between and among the disciplines must be strong in order for developing knowledge to move smoothly and efficiently from the basic research sector into actual applications. Feedback loops from practitioners to basic scientists and to clinical investigators need to be strong. There also need to be improved mechanisms for milking all basic and clinical science advances for their application to real-world problems, particularly for very burdensome problems. It is probably unwise to assume that

Health in the Decades Ahead

the potential applications of many research advances are systematically assessed and implemented—often, in fact, the various portions of the research continuum function in isolation from one another. Such fragmentation, then, is yet another problem that is of concern in the current health scene.

The field of international health also is seriously problematic, particularly as regards the developing countries. The burden of early death and long-term disability in most countries of the world today is staggering. Putting exceptions like Sri Lanka aside, it is fair to say that the burden of illness may become truly crushing unless major research programs leading to better treatment and prevention strategies are undertaken. Health problems go right to the heart of the matter of development. Development will probably be impaired if a large proportion of the people are ill or debilitated, or at least lacking in stamina. And yet that is the situation in many of the developing countries, which may become the never-to-be-developed countries unless the burden of illness can be eased.

But the focus here is on future trends, so let us turn to others that are encouraging. Of great significance will be new understanding of the possibilities for preventing many of this nation's most crippling, disabling diseases. In California recently, studies by Breslow and Bellock of about 7,000 adults, followed for about six years, showed that life expectancy, health, and chronic disease are related to some basic, very simple health habits. Factors that emerged as highly health-relevant in this large-scale study of mid-life included: three meals a day at regular times and no large snacks in between, breakfast every day, moderate exercise two or three times a week, seven or eight hours of sleep a night, no smoking, moderate weight, little or no alcohol intake. A 45-year-old man who practices zero to three of these habits has a remaining life expectancy of about 22 years. He can expect to live to age 67. But a 45-year-old man with six or seven of these habits has a life expectancy of 33 additional years—to age 78. Such research suggests that 11 years could be added to life expectancy at age 45 by an alteration in life style.

Based on this type of analysis, it will probably become increasingly clear that the health system has all kinds of interdigitations with other systems—such as housing, transportation, and the general environment—going beyond the realm of medical practice. Such evidence puts more emphasis on what individuals can do for themselves—partly with the doctor's guidance,

stimulus, and encouragement, and partly with an individual's own knowledge and judgment. Research in the future will probably (we hope) pay much more attention to the behavioral aspects of health, such as diet and exercise, tobacco and alcohol use, and much more attention to the possibilities for prevention of disease.

Related to these observations is another piece of evidence, from quite a different sphere. Experiments in several animal species, including some primates, show that the lesions of atherosclerosis do in fact regress, diminish, or even disappear with changes in diet. That is, if a chronic high-fat diet is reversed to a low-fat diet, the actual lesions in the arteries, including those of the coronary arteries, will regress.

Future research will focus much more sharply on these issues. Another interesting bit of evidence from studies of people in mid-life suggests that there is ample capacity for learning in mid-life and beyond. It appears that our folklore about inability to learn in later ages is mostly nonsense. This new appreciation of our later-life learning capacity will be of great significance as the proportion of aged people in our society greatly increases in the next half century. Clearly, if an individual wishes to change his habits and would like to live longer, major changes in behavior are possible.

The basic orientation that flows from these observations is that the nation can and should begin to look toward primary disease prevention aimed at environmental and life-style factors that contribute to illness and death. Some of these are addressed to individual behavioral changes, and some are matters of social organization that involve the urban environment, education, transportation, and so on. They involve large issues of public education, and the need to give people more choice about how they will use their lives and, in effect, how long they want to live. This is an immense task that requires far more collaboration than we are accustomed to in medicine—not only collaboration across scientific and professional disciplines, but across government and educational sectors. Although there is going to be plenty of difficulty and a lot of hand-wringing, the next decades will no doubt see considerable progress in this area.

Two particular efforts at prevention research, which probably signal a future trend, deserve special mention. Although preventive interventions are typified by references to vaccines and medical screening

techniques, the evidence is growing that other interventions hold important promise for savings in human life and health. The Stanford Heart Disease Prevention Program has done much to demonstrate that community-based health education campaigns can aid in prevention of cardiovascular diseases. The program mounted mass media campaigns in two California towns to teach about the risk factors of cardiovascular diseases and how to reduce them. Some of the highest risk residents in one of the towns also were given intensive instruction in person. Results were encouraging. Randomly selected individuals had a 12 percent reduction in total predicted heart attack scores after one year of the campaign, and a 24 percent reduction after the second year. Of the 24 percent risk reduction achieved in both towns, almost 15 percent in one town and 10 percent in the other were due to lowering of blood pressure, either through medication or diet or both. Cigarette smoking was markedly reduced.

Another preventive program that is not so well known, and which is very new, has been operating in a rural county of Finland during the last five years. The entire population of that county, 180,000 people, has been exposed to an intense health education campaign aimed at reducing the community's high rate of cardiovascular disease. Males in Finland have the highest mortality rates in the world from coronary heart disease, due in part to their tradition of high-fat dietary intake and in part to their tradition of heavy cigarette smoking. An interdisciplinary team involving clinical medicine, public health, and behavioral science has been working to diminish those risk factors. The public education program has involved the mobilization of private organizations in the communities and some legislation—particularly for the forbidding of smoking in public buildings and in public transportation. The cooperation of the dairy industry was enlisted, and the public has responded by reducing its fat intake substantially—switching from regular to low-fat milk, from butter to margarine, from regular high-fat sausages to sausages made with a large mushroom content. Fresh vegetable intake has increased, and the results show a considerable decrease in smoking and blood cholesterol levels. For the first time in 30 years in that county, the seemingly inexorable annual increase in the numbers of heart attacks has leveled off, and there is some evidence that the incidence of strokes may be decreasing as well.

These experiences in California and Finland suggest

that community-based prevention programs combining clinical medicine, public health, and behavioral science can effectively reduce the risk of cardiovascular disease and some forms of cancer. Broad, interdisciplinary approaches such as these, focused on prevention, will probably increase throughout the world over the next several decades.

Before leaving this emphasis on the need for future work in prevention, special mention should be made of one particular age group that may prove to be crucial to the prevention effort—early adolescents. Young people in this developmental phase fall between pediatrics and adult medicine, between child and adult psychiatry, between grammar school and high school. As a special group they are largely ignored. And yet it is during early adolescence, roughly 10 to 15 years of age, that many behaviors with great relevance to health are initially explored and developed into habits that may be carried into adulthood. The use of alcohol and other drugs, cigarettes, the patterns of exercise, nutrition, sexual expression, and use of motor vehicles are often first addressed in this developmental stage. Some of these behaviors pose immediate risks and benefits to health; the health consequences of others become manifest only in later life. Smoking, for example, has relatively minor health consequences to a youngster when first begun; however, if smoking becomes a habit, the health consequences in 20 to 30 years are enormous. This “time bomb” concept may well become central to future research and programs directed at disease prevention. If ways can be found to encourage adolescents to adopt health-enhancing rather than health-compromising behaviors, the possibilities for preventing future and long-term chronic diseases in particular become most significant.

Laboratory-based research points to new future trends as well. One of the great advances in biomedical research having enormous significance for the future has to do with the delineation of some small molecules that are produced by the pituitary gland and that have far-reaching effects on the reproductive systems and on our experiences of pain, among other things. Work on the brain and pituitary peptides will probably lead to better treatment of pain, which will have great bearing on what life is like for the elderly with chronic diseases.

This research may also lead to a wider range of chemical, reversible contraceptives. Indeed, a whole new range of contraceptive techniques will probably be

continued on page 24

developed in the next decades. One promising direction at the present time involves putting small amounts of hormones into the uterus to prevent pregnancy. These hormones are released very slowly so that the doses involved are safer than current ovulatory suppressants and the effective time spans longer than present techniques allow. Another approach involves the development of a safe, reversible chemical intervention in males—a step forward that should be a welcomed divergence from the over-concentration on contraceptives for women. Still another involves practical applications of prostaglandins.

Even given this future promise, however, we will need a deeper understanding of the reasons why present contraceptive technology has been taken up so slowly and haltingly in many parts of the world. It has become increasingly clear that the introduction and dissemination of contraceptives have often come into direct conflict with deep-seated traditions and cultural norms. In many societies, for example, it has long been believed that it is very desirable, and even necessary, to have large families—or, more accurately, to produce many sons. That belief, taught early in life and invested with strong emotions, is very hard to change. Such attitudes are obviously antithetical to many contraceptive and population-control strategies. Increasingly aware of such problems, the World Health Organization (WHO) is now paying attention not just to the biological nature of contraceptive techniques, but to their more general acceptability as well—culturally and socially. Future work in this area is likely to be critical to the development of reproductive patterns that are compatible with decent standards of living and healthy populations.

The international health area is also likely to achieve much greater research and service attention in the next decades. It is already clear that

many relatively simple public health measures would help ease the international burden of illness enormously. There are about a billion people in the world who cannot conveniently and safely drink or wash with water. There are hundreds of millions of people without even minimum sanitation facilities. In the future this problem will probably be tackled village by village with sanitary reform, as exemplified by the use of hand pumps in Pakistan and some other countries. These simple instruments do much to prevent disease by drawing needed water from underground rather than relying on the disease-laden surface water. Such combinations of medicine, engineering, and the behavioral sciences are hopeful signs. The science base of the biological revolution can and will be applied to tropical diseases. Another hopeful sign is that the WHO is establishing collaborating networks of laboratories around the world to address the massive health problems of the developing countries. One program that is quite successful is concerned with human reproductive biology, and another that is showing much promise focuses specifically on tropical diseases.

The whole field of vaccine development and use is of special promise in the next decades. We have seen just this year the culmination of a remarkable effort led by an American, D. A. Henderson, in the WHO, that seems to have virtually eradicated smallpox throughout the world. Yet this success story is still an exception in the vaccine area. Vaccines are clearly not being utilized to their full potential, particularly internationally. For example, measles is a much more serious problem in developing countries than it is in the United States. When measles occurs in the context of malnutrition, which is pandemic in much of the world, the probability of also suffering encephalitis and some lasting brain damage is relatively high. Therefore, the potential utility of the

measles vaccine for furthering disease prevention in the developing world is even greater than in the U.S.—although the value to this nation of the vaccine is also high.

The U.S. record on vaccine utilization, incidentally, is rather grim. In 1974 only about 67 percent of white children and 45 percent of non-white children in this country from ages 1 to 4 had been vaccinated against polio. The comparable figure in northern European countries is above 90 percent. It thus seems that in our own nation there is a “less developed” subnation that shares many of the health deficits borne by other countries. In any event, the utilization of existing vaccines in developing countries is certainly a field in which much progress will be made in the years ahead.

We can hope that the role of the United States in tackling international health problems will increase. It is probably accurate to say that this country has more strength in biomedical and behavioral sciences pertinent to health than all the rest of the world. But only a tiny fraction of this capacity is directed toward the problems of the developing countries. If the United States were to shift a part of its health research attention to the needs of other nations—and have a sizable cadre of our most skillful health professionals working on these matters instead of just a handful—the impact on worldwide health status could be very great.

The hazards of predicting future trends in the biological and clinical realm are great enough; the hazards of such prediction in the social realm are greater still. The vast scale, the heterogeneity within and among societies, the great impact of scientific and technological change, and the consequent social ramifications are beyond any guidelines provided by human history. All these make predictions terribly difficult, and yet a few words should be added about future

developments in this country in the area of the organization of medical care.

There appears to be a great determination in this nation at present that, one way or other, a system of national health insurance should be developed. The United States is the only industrialized country in the world that does not have either a system of national health insurance (NHI) or a directly operated national health service. While it is unlikely (for a variety of social and historical reasons) that a directly operated national health service will be established, even by the 21st century, the gradual phasing in of an NHI system over the next few decades is likely. The benefits provided will probably be narrowly defined at the outset. Some phrase like "a decent minimum" will limit benefits initially, although reasonably adequate care in many spheres will be covered, including at least modest coverage for those neglected twins, dental and mental care.

In the early years of this system, coverage will focus on curative efforts with less emphasis on prevention; later, the prevention approach will become more prominent. Protection against financial catastrophe resulting from health problems will probably be a cornerstone of the plan, although individuals would possibly be expected to bear some significant part of the cost in relation to personal income. For decades to come, a mixed public and private system, rather than a monolithic, totally public system, is envisioned. Because of this country's history of adapting existing institutions to new functions, national health insurance will probably build on current arrangements rather than construct wholly new ones.

The advent of national health insurance will bring multifaceted cost controls in the health area, linked in some way to simultaneous assurances of the quality of health care. An example of this coupling of cost control

and quality assurance would be the completion of scientific studies indicating that the use of a certain high-technology, hospital-based technique is unnecessary in specific instances and also highly risky. Based on these findings, the administrators of the health insurance system might well deny coverage for inappropriate uses of the technology. From this action, use of the technology would diminish. This utilization decrease would reduce certain costs, and at the same time improve the quality of health care by avoidance of unnecessary risk. Not all cases will be so clear-cut, but the principle is one of growing importance.

One of the fundamental concepts that will undergird this future system is that the insurance coverage will apply only—or primarily—to services that have been validated scientifically, so that risks and benefits are clearly documented. The costs to the nation of paying for interventions that have not been proved effective, or have unacceptable risk/benefit ratios (a determination that is initially technical but ultimately social) will be of great concern. Consequently, as a cost-control as well as a quality-control measure, validation and assessments of interventions will be required before they are widely disseminated or covered under an insurance plan.

Today, of course, insistence on careful study of a technology before its widespread use is not generally the case. For example, the use of computed tomographic scanners, or "CT" scanners, has generated much public interest. CT scanning is a recently developed technique that combines radiographic and computer techniques to produce cross-sectional images of the head and body. Whereas conventional X-ray films show internal structures superimposed upon each other and, therefore, are best suited to high-contrast structures such as bone, the CT scanners can produce high-quality images of soft-tissue structure. CT scanners have not only been developed

for diagnostic visualization of the head, but also for the full body.

This technology has been adopted in this country on a massive scale (more than 800 head scanners are now in place), at great expense both at time of purchase and in maintenance and operation. This dissemination, however, has occurred prior to the completion of studies to determine appropriate use, accuracy of diagnosis, risks, and so forth. In the absence of such research, insurance companies and public third-party payers have faced difficult decisions in establishing policies for the reimbursement of scanner use, because the evidence for both the risk and benefit is sometimes no more than a clinical impression.

It has long been true in medicine that interventions have gained great popularity even in the absence of careful efficacy and safety assessment. Often society has relied on wise people making shrewd observations to adjudicate risks and benefits. Sometimes, however, this "wise man" approach leads to unfortunate mistakes. For example, radiation of the neck for various alleged preventive purposes many years ago now appears to cause cancer of the thyroid. Through hindsight, these risks became evident. With new awareness of costs and the need for assurances of benefit that a publicly financed health insurance scheme will bring, more casual and impressionistic standards of evidence will gradually give way to more rigorous methods.

Another example of this efficacy/cost issue is presented by linear accelerators. Small linear accelerators, which were constructed after the large accelerators such as that at Stanford University had been developed, have been used to treat cancer patients. One might logically wonder whether or not the larger linear accelerators or other high-energy physics machines would also be of use in cancer treatment. Years ago, the cost of constructing the two-mile Stanford Linear

Health in the Decades Ahead . . . *continued*

Accelerator Center was about \$114 million; in current dollars, the cost would be much greater. What will happen if it becomes clear that there are specific cancers which can be cured only by treatment with such enormous machines? Will they appear in every doctor's office, costing a quarter billion dollars? Clearly not. There will have to be some kind of system (a) to insure that the therapy is both efficacious and of an acceptable cost/benefit, risk/benefit ratio; (b) to spread that cost in some equitable fashion; and (c) to ration access to the machine in some appropriate way. Such requirements will probably mean that as new, expensive treatments are developed, reimbursement or even use of the treatment will be contingent on the provider and/or patient being enrolled in a national, carefully controlled clinical trial. Such trials are the only mechanism currently available to generate the risk/benefit data required for the rational use of health care resources. They can also assist in controlling the dissemination and proliferation of

technologies that have not been adequately assessed.

One further aspect of the organization of health care that is likely to be increasingly important in the future is the multi-specialty group practice concept; one branch of this tree has come to be called "health maintenance organizations," or HMO's. The pooling of physicians and other health professionals is clearly a concept that will gain increasing utility in the years ahead. It is easier for health professionals to keep up with new developments if a collective approach is taken. It is easier to provide 24-hour, 7-day coverage and emergency services through a group practice rather than through a solo practitioner. At the same time, it is possible to preserve to a large extent the individual doctor-patient relationship. Group practices seem to produce a kind of mutual-aid ethic, which will probably continue to grow, in the form of more health maintenance organizations, and other forms of organized health care settings will increasingly be linked to the workplace. In any event, both the work-

place and the school are likely to be used more for preventive medicine and health education.

While the developments sketched here seem reasonable to project over the next several decades, it is possible that transforming influences beyond our present vision may have impacts far beyond those noted. The world we have made through science and technology since the Industrial Revolution has little precedent. As we move into a complex future at rates of change unknown to our early ancestors, we must develop a broader science base and a more compassionate society, not only to cope with disease and disability, but to improve the quality of life altogether—and perhaps even to survive as a species. □

Books . . . *continued from page 3*

represented in this volume, it is impossible to identify any single unifying viewpoint. Nonetheless, all of the essays do seem to address certain basic questions. One of them concerns identifying the problems future generations will have to face. Can we predict with accuracy the nature and extent of future world problems? Brown and his colleagues are pleased with their past performance. On the whole, Brown tells us, their "batting average" has been pretty good. Twenty years ago, for example, they predicted that there would be close to five billion people inhabiting the earth by the year 2000. As things stand in the seventies, the world population is currently over four billion and still rising. They also predicted that

petroleum production in the contiguous United States would peak in 1970, and this too proved to be correct.

At the same time, there were notable failures. In addition to neglecting environmental problems and not foreseeing the vulnerability of industrial societies to boycotts of essential materials and services, Brown and his associates, like others in the fifties, overestimated the demand for PhD's in engineering and science. Moreover, while they predicted the depletion of petrofuel resources in the United States, they were overly optimistic about the future of nuclear energy as a replacement. They did not anticipate the rising concern for public safety in the seventies.

What this seems to suggest is that

both changes in conditions per se and in social goals and values can complicate the task of prediction. Viewed retrospectively, the supply and demand of nuclear energy depended upon changing perceptions about the value of a safe environment, as well as upon the costs of development and the availability of resources. Apparently our success in predicting future problems hinges in part upon our ability to say what the goals and values of future generations will be, and that is a very difficult task.

Can one identify future world problems with a high degree of accuracy? Most social scientists think not. The future is characterized by too much uncertainty to project accurately 100, 90, or even 80 years ahead. On the