EDITORIAL

Public Health in the New Millennium I: Technology

To compare public health today to public health a thousand years ago is to compare apples and bicycles. A thousand years ago, women routinely died in childbirth, most people did not live to see the age of 40, minor injuries often led to disability, and minor illnesses often meant death. The difference between then and now is so great as to be practically unfathomable. It is perhaps easier to think about a hundred years ago. Looking back at the high mortality rates for tuberculosis, diphtheria and croup, diarrhea in children, "diseases of the nervous system," and "acute respiratory diseases" and the extremely low rates of death from cancer, heart disease, and "diseases of the arteries," we see the extraordinary strides made in science and the concomitant shift to chronic diseases and diseases of old age. Machines to keep people alive were the stuff of science fiction, and a population of "over-80s" as the fastest-growing age group in America was equally fantastic.

We enter this new era with much of the science fiction of the 1930s, 40s, 50s, and 60s having become science fact. Until this year it seemed as though only two major themes of science fiction were beyond our realistic expectations: generalized extrasensory perception and time travel. Now, as physics reevaluates Einstein's work, even the notion of time is changing.

As the calendar moves ahead, we understand our good fortune to live in a time when life expectancy, infant mortality, and maternal death in childbirth are dramatically improved, when some diseases have been eradicated entirely, and when technological advances occur with increased frequency and speed. Few of us would trade places with those who lived when strep throat could lead to death, when heart attacks were not survivable, when communities were without running water and sewer systems. We look forward to the day when cancer is eradicated, and babies enter the world without birth defects. We justifiably look to the next millennium with the expectation of new advances and breakthroughs, some that we can anticipate and some that we, like our forebears a thousand years ago, cannot even imagine.

As a nation we are committed to accumulating knowledge and advancing science. The budget for the National Institutes of Health has doubled in the past 10 years; to spur private research and development we have enacted and expanded tax credits for private industry; we fast-track approvals for new and promising drugs and devices; and both public and private insurers are urged or required to pay for their use. Public health, with its emphasis on epidemiology and biostatistics, has often paved the way for fruitful research and, with its responsibility for population-based health, has led the charge for broad dissemination and use of information and technology. And it is public health's commitment to human rights, to health access, and to prevention that are needed in the evaluation of technology.

As we contemplate the success of the Human Genome Project and the development of more and more new pharmaceuticals and devices, we must raise another set of questions. Is it always right to apply our scarce resources to finding technological solutions? Is the technological solution always the optimal one? Does our fascination with and belief in technology preclude other, better solutions? Have we examined the consequences of using this technology? Have we prepared the societal, economic, and structural environment for the changes this technology brings? Do we promote or downplay other values, such as fairness, equality, justice, liberty in the use or dissemination of this technology? The most profound breakthroughs in the next millennium will lie not in technology—although technology is profoundly important—but in advancing the principles that lead us to compassionate and rational answers to these questions.

Former US Arms Control and Disarmament Agency Director Paul Warnke observed that once a weapons system becomes technologically feasible, it becomes politically inevitable. His dictum referred to arms, but is equally applicable to medicine. Because we can develop a technology, we do. So because we can, we keep people alive in late and painful stages of illness and frailty, we rescue extremely premature babies who will face severely diminished lives, we apply aggressive procedures to "cure" infertility and experience a concomitant rise in infant mortality. Because the technology exists, we use it, but we do not ask whether we should do so, or whether we should have put our resources into developing it in the first place.

This is not an argument against technology; a Luddite has no place in serious discussions about how to end disease or improve or extend life. It is merely a call for the public health community to insist that decisions about technology must include consideration of the unintended consequences, must examine all the costs of new technologies, including the opportunity cost, and must raise questions of equity and justice.

Consider AIDS, which threatens to wipe out entire societies in Asia and Africa within the first quarter of the new century. For nearly 20 years, we have poured millions of dollars into burdensome "cocktails," elusive vaccines, and undeveloped cures, all of which, even if one day per-

fected, will be too expensive for most HIV-infected people—or their governments—to afford. During those same 20 years, AIDS has grown to pandemic proportions. By insisting on a technological solution and failing to direct more of our political, social, and economic resources to AIDS prevention, we have surely missed an opportunity to slow the spread of disease.

The choice is not between technology and prevention, between education and cure. Work can and should continue both on drugs that relieve or cure AIDS and those that might prevent it. But to ignore the fact that the new "miracle drugs" are increasingly available only to those in developed countries and too often only those with private health insurance is to be disingenuous at best. And in addition to the medical/technological and prevention approaches, we need to create a social culture that encourages people to want to take care of themselves and each other so that they neither spread nor contract disease. The public health profession can provide the leadership to influence society toward creating this kind of culture and to finding the mechanisms to ensure that when technology provides relief, the technology will be available to all.

More than 25 years ago, Lewis Thomas, no foe of technology or science, raised many of these same questions and concerns regarding the development of the artificial heart. He decried the emphasis on cure instead of on prevention and the reliance on short-term solutions rather than long-term change. And he was worried about fairness: "Who will decide that only certain patients, within certain age groups, will be selected for this kind of lifesaving (or at least life-prolonging) technology?" he asked. Today we can add race, gender, behavior, and nation to age and medical status.

This issue's lead article on obesity illustrates these dilemmas. As challenging as it is to develop technological solutions, it is apparently even harder to undertake the social, economic, and political steps necessary to address serious public health concerns. Perhaps that is because it is so difficult to quantify and control social solutions. But perhaps more to the point, social solutions to public health problems typically fail to yield products that earn profits. Technology, in contrast, can be wildly profitable. Rarely are government and insurers under as much pressure to approve and pay for technology as they are when the issue is weight control—there the pull from consumers equals the push from manufacturers. But it is equally true of diabetes and asthma that the money to be made from treatment is easily quantified while the money to be saved from reducing their occurrence is harder to quantify and more dispersed.

When we open our public health toolbox, our choice of tools should depend on our priorities, instead of our priorities being set by our choice of tools. For example, as we proceed with mapping the human genome, we entertain dreams of engineering disease-free humans. But as we chase that dream, what opportunities do we miss? How many children continue to be neglected? How much human potential goes unrealized because of lack of education or opportunity? The point is not that we abandon the Human Genome Project. The point is balance. Poverty, bigotry, violence, substance abuse, and ignorance are public health issues, too, and they too merit our attention and commitment.

Our search for solutions must be multilayered and multifaceted. Once the map of the human genome is complete, our response to disease should not rely on the predictive and determinative quality of genes alone. We need to learn what factors outside the human organism might trigger a gene in the direction of disease. Correcting those factors may prove to be a better answer to prevention than tampering with the gene itself. Solutions may be found in genetics, antibiotics, the environment, human behavior, or all of these and more. The cure may lie in prevention, medical intervention, education, or government regulation, or a combination of approaches.

The role of established medical and governmental institutions may best lie in supporting changes in the social fabric of neighborhoods, cities, and towns. Improving public health might mean working to strengthen the social network for those who feel forgotten. For example, research shows that child abuse declines when parents feel less isolated and more supported by family, friends, and neighbors. Research also suggests that pregnancy rates are lower among teenage girls whose futures include brighter educational and employment opportunities. Here, improved public health might mean creating social environments in which girls can envision other options for themselves besides premature motherhood, and girls and boys can see each other as whole people, not as the means to an end.

Responsible consideration of public health problems must include acknowledging the great disparities in income, wealth, resources, and power that began in the last quarter of the 20th century and, absent intervention, are likely to continue into the new century. Our goal is not only to reduce disparities, but to ensure that health status does not reflect them.

Technology must of course continue to advance. But the discipline of public health needs to be more aggressive about relating technology and medicine to the larger questions of human existence. The smaller the unit of our concern, the less public, it seems, are our solutions. Our solutions must be public. We need to shift our perspective from genes to cells, from cells to human organisms, from individuals to families, from families to neighborhoods, from neighborhoods to environments. We must deliberate as if we cherish all of our people and in the broadest sense create and maintain the conditions in which good and healthy lives may thrive.

—Judith Kurland ∎